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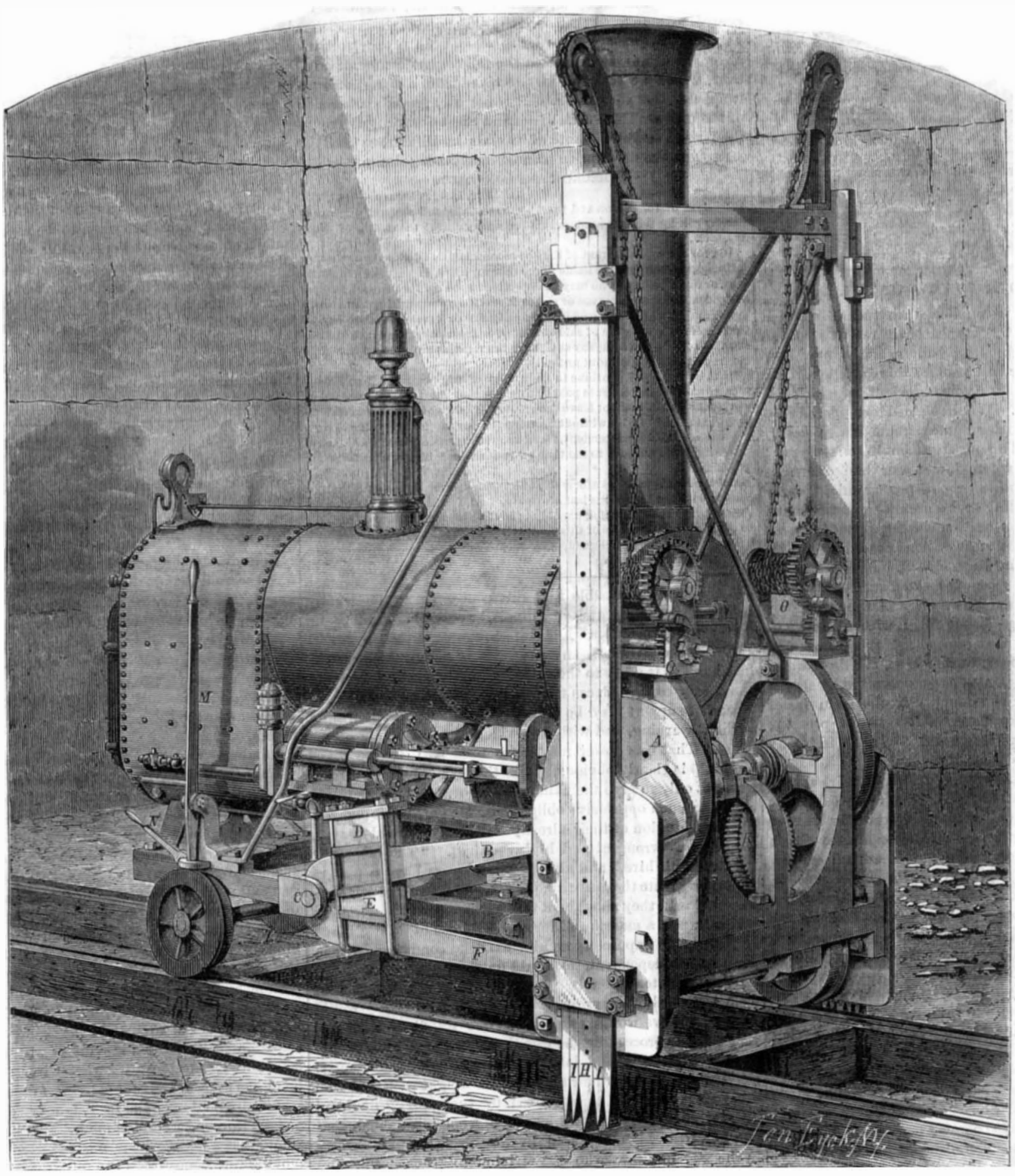
IMPROVED STONE QUARRYING MACHINE.

The largely increasing demand for stone for building purposes calls for the introduction of labor-saving devices which, while increasing the supply, will tend to lower its cost of production. To this class belongs the machine which we herewith illustrate, and which is extensively used for channelling or cutting stone in various quarries throughout the country.

It is a double gang machine, and is represented mounted upon its track on the bed of the quarry. The frame which supports the boiler, engine, and other machinery, consists of one piece of forged iron, thereby gaining great strength and durability. The principal portions of the device to which it is necessary to call attention in detail are the cutters, the mechanism which actuates them, and also the connections which render the machine locomotive. The engine is of six horse power. Through the interposition of suitable appliances the piston rod imparts motion to the crank face plate, A. This, in turn, by means of a swivel stirrup applied to its wrist pin (not shown) moves the upper arm, B, of a bifurcated or compound lever, which is pivoted to the frame at C. Arrangements are provided by which the throw of this arm can be shortened and, as will be seen, the movement of the cutters regulated. D and E are springs of rubber, or other elastic medium, arranged above the arm, B, and between it and the lower arm, F. A clamp passes around these springs, as shown, and serves to adjust them, and also to connect the two portions of the lever. The free end of the arm, F, actuates the gang of chisels on its side of the machine. The latter consist of five bars of steel, pointed at their lower ends and clamped together by head and foot clamps or guide blocks, with the lower of which, G, the lever arm, F, connects. Of the five, two chisels, I I, have diagonal cutting edges, and three, the middle, H, and two outer ones, have their edges transverse. The middle chisel, H, extends the lowest, and all together form a stepped arrangement each way from the center. By this device it will be seen that when the machine is moving ahead the two forward and middle cutters operate; on a retrograde motion being assumed the two rear chisels, in connection with that in the center, do the work.



WARDWELL'S STONE QUARRYING MACHINE.

The bars are from seven to fourteen feet in length, according to the depth it is required to penetrate, and are supported by standards arranged on each side of the frames. At their upper ends, on one side, they are serrated to match corresponding serrations in the head clamps, for the purpose of preventing any displacement of the cutters while in use. J is a worm on the main shaft, and actuates the toothed wheel, K. The axle of the latter extends diagonally downwards to the rear of the machine where it terminates in a bevel pinion which, by the lever, M, may be thrown into action with either of two adjoining bevel wheels—part of one of which is shown at L—on the axle of the rear trucks. It will be readily understood that the motion thus communicated serves to turn the axle either backward or forward, according to with which wheel the pinion is caused to engage. When the machine is required to be stationary, the pinion is so placed in reference to the wheels that neither is moved. N is a hand lever which communicates with suitable mechanism which serves to lock the pinion in whatever position it may be situated. O O are winches from the barrels of which chains are led, as shown, over pulleys, and are connected with the cutter bars. Their object is to afford a means of withdrawing the latter from deep channels. The mechanism for driving the gang of chisels on the opposite side of the machine is of course the same as that already described.

From one to two hundred blows per minute can be delivered with each gang of cutters, and the penetration, we are informed, will be about three fourths of an inch each time the apparatus is passed over a given surface. The channels are generally cut down for from four to six feet, and may be of any desired length. It may be noted, as an important advantage claimed, that their sides, as made by the chisels, are quite as true and as even as a sawn surface, so that the machine serves the double purpose of dressing as well as quarrying. The track can be made in sections to extend any desired distance.

The general use of this invention in the marble quarries of Rutland, Vt., during the past seven years has fully demonstrated its efficiency. It is stated to have averaged from 50 to 100 feet of channel a day during the quarrying season, thereby performing the labor of from 50 to 75 men.

Several patents have been granted upon its different portions and improvements thereon. Geo. J. Wardwell is the patentee. Further information may be obtained by addressing the Steam Stone Cutter Company, Rutland, Vt.

The Works of the Joliet Iron and Steel Company.

This establishmennt occupies an area of some one hundred acres on the Chicago and Alton Railroad, at Joliet, Ill., and is one of the largest of its class in the United States. There are two blast furnaces of a capacity of 1,400 tuns of pig iron per week, which, together with the hot blast stoves, boiler, and engine house, casting house, etc., occupy a structure 420 by 240 feet in dimensions. Twelve boilers and four large engines are here employed. The water works, situated to the north of the furnaces, contain a boiler and two steam pumps capable of throwing 1,600 gallons per minute each. In the buildings devoted to the processes of coke making and coal washing, are 25 brick ovens of the most improved form, and also two washers with extensive machinery. Twenty-five tuns of coke and one hundred and fifty tuns of washed slack are produced daily. The fire brick works occupy a system of buildings 400 feet long, fitted with grinding and molding apparatus, boiler, engine, kilns, etc., and are capable of making 3,000,000 bricks per year.

The Bessemer plant has a capacity of 700 tuns of ingots per week. Two five tun converters are used. The new steel rail mill occupies one of the largest edifices. The steel rail train is divided into three stands of short rolls, so as to insure great strength. There are six Siemens furnaces of the largest class, and a blooming engine and blooming train. The capacity of this branch of the establishment is 1,000 tuns of rail per week. The iron rail mill is provided with an artesian well, and, besides other machinery, has eight heating furnaces and a three foot horizontal engine with a 28 tun twenty foot fly wheel. Six hundred tuns of rail per week are here manufactured. The puddle mill has nine double puddling and one double heating furnace, and produces two hundred and fifty tuns of muck bar per week. The shops are of sufficient capacity to keep in repair all these works, and also a second Bessemer plant and merchant mill, if required.

A PATENT OYSTER.—Where will the genius of the American inventor end? A down east journal informs us that a Maine man is about to apply for a patent for an artificial oyster, made out of flour paste, tapioca, salt and water. The inventor places these in second hand oyster shells which are carefully glued around the edges; and when a half intoxicated customer calls for a dozen raw on the half shell, he gets them fresh from the shop.

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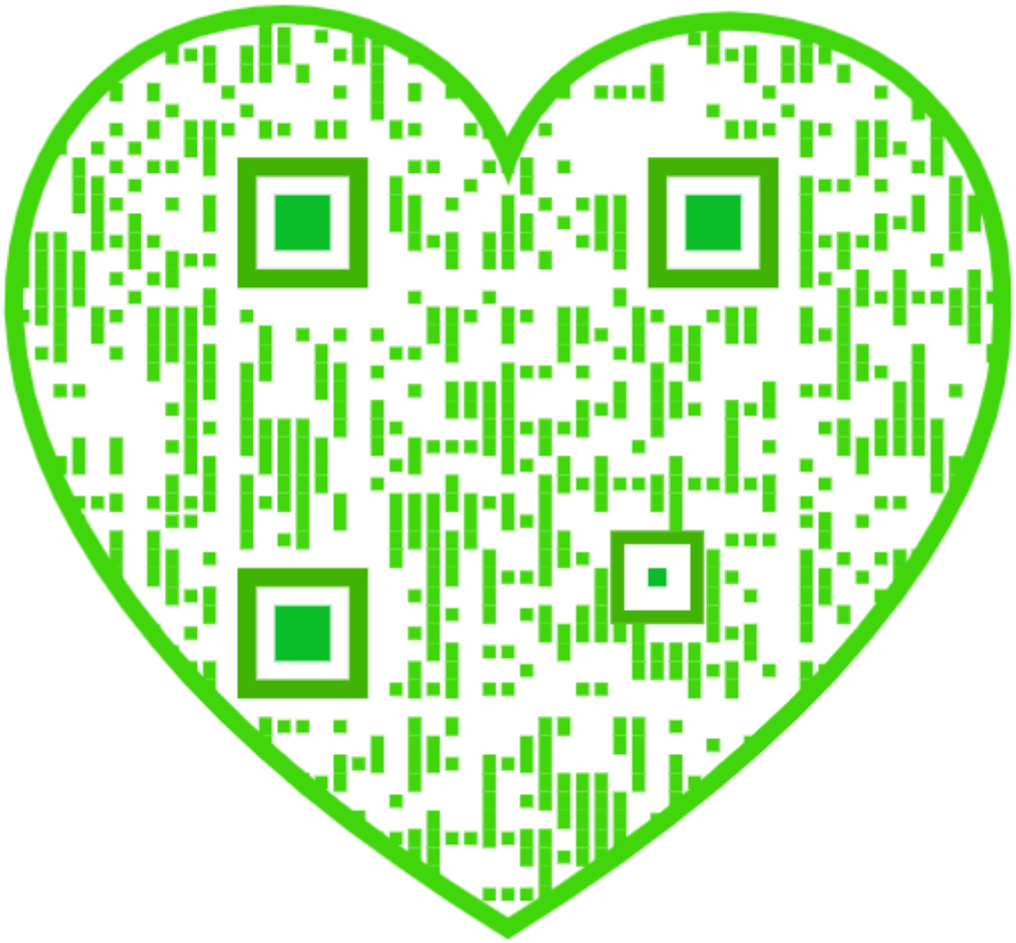

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EXPLOSIONS DUE TO LOW WATER.

In our issue of March 8, we published an article in which we exhibited the fallacy of the popular ideas relating to the consequences of low water in steam boilers, and showed how collapse, even, might occur as a result of this condition. We related a case, as described by a correspondent, in which collapse actually took place. We explained the manner in which explosions might, under some circumstances occur, and, in conclusion, summed up our argument in the statement that overheated surfaces, where low water had occurred, might produce either explosion or collapse, or might cause no dangerous result, according to the peculiar circumstances of the individual case. The question of a correspondent leads us to take up the special case of explosions caused by the increase of pressure which may be produced, in some cases, by the injection of feed water upon overheated surfaces.

In the article above referred to, we showed the possibility of cold feed water, entering a boiler filled with steam, producing the condensation of that steam and the consequent collapse of the boiler. Should, in any case, the feed water be too warm to produce instantaneous condensation, or should it be evaporated so rapidly as to supply fresh steam faster than condensation could take place, an increase of pressure would occur which might produce, and probably in many cases has produced, the explosion of the boiler.

Let us suppose, as an extreme case, a plain cylindrical boiler, of 42 inches diameter and 30 feet length, to have become completely emptied, by some accident, and then to have a supply of water forced in under the conditions last described. We may easily calculate what pressure of steam will be produced, if the feed water were boiling and the plates red hot,—conditions most favorable to increase of pressure. Such a boiler, if of quarter inch plate, would weigh not far from one and a half gross tuns. If the fire line were at the middle line of the boiler, about 1,800 pounds of iron might become red hot, were the boiler to become empty. Nine pounds of red hot iron were proved, by Professor Johnson and the Committee of the Franklin Institute in investigation of this subject, to contain heat enough to be just capable of evaporating one pound of water. Seventeen hundred pounds of iron might therefore evaporate $\frac{1800}{9} = 200$ pounds of water, under most favorable circumstances. This weight of water, occupying the full capacity of the boiler, 290 cubic feet, would produce a pressure of about 300 pounds per square inch. In one actual experiment by the Committee of the Franklin Institute, the pressure rose above 200 pounds per square inch, when it overcame the resisting power of a portion of the boiler, and they were unable to determine the maximum limit.

The case which we have supposed would, evidently, be likely to produce explosion, were the pressure not relieved by the safety valve; but it must be remembered that this is the extreme case, and one likely to be seldom met with. It will rarely happen that one half a boiler will be thus heated to a red heat, and that it will yield its surplus heat to heated and rapidly injected feed water; and even then it is only when the safety valve is inoperative that the pressure can reach the indicated figure. Suppose a boiler of the locomotive type to have its crown sheet similarly overheated, while a heavy pressure still exists within it, say 120 pounds. By similar calculation we can readily determine the increase of pressure. The crown sheet being, say 1 feet square and $\frac{3}{8}$ inch thick, and the boiler containing 100 cubic feet of capacity above the then existing water line, the pressure, if unrelieved by the safety valve, would, in this example, rise to nearly 800 pounds per square inch, except for one very important circumstance: that is, that saturated steam already existing would, as shown by experiment, be condensed by the slightest increase of pressure and, thus yielding before the newly developed vapor, the result would be that the pressure would really be but very slightly increased. It is far more likely that, in this case, the overheated crown sheet would yield from simple weakness, and that an explosion would result in tha manner, as has actually occurred under our own observation.

Our readers will be very likely to agree with us, we think, when we draw the conclusion that the statement that "water coming in contact with red hot iron creates a gas ten times as explosive as the best gunpowder" requires some modification. Learning more precisely in what manner deficiency of water produces danger, those among them who have steam boilers under their charge will be able to act more intelligently in avoiding such risk.

INJUSTICE TO WORKMEN.

It is always the case among antagonistic parties that there are a few on either side who rush to extremes and, by their precipitate and ill advised measures, neutralize such satisfactory adjustment of the question in dispute as might be effected through the efforts of the more cautious and conservative majority. We have given a multiplicity of instances of the imprudent proceedings of trade associations, and have repeatedly condemned the coercive system which these societies have seen fit to adopt in order to compel the support of disaffected working men. From the following document, however, which we have recently received from a correspondent, it appears that the extremists are not all arrayed on the side of the unions. The Joliet Iron and Steel Company is one of the largest establishments of its class in Illinois, as will be seen from the description printed in another column.

RECEIPT AND CONTRACT.

JOLIET, ILL., February ——, 1873.

Received of Joliet Iron and Steel Company, the full amount due me as per pay roll for services rendered said company during the month of January, 1873.

And for the consideration of the above mentioned, I do hereby agree that said company shall not be liable to me (nor my heirs, executors, administrators, or other persons who may be dependent upon me for support in case of my death) for any damage or accident resulting or occurring to me while in its employ, whether caused by the negligence or carelessness of any of the officers or employees of said company, or from any other cause whatsoever. And that said company shall have the right, at any time, to discharge me from its employ without notice.

Further, that I will continue in the employ of said company from month to month at the current rate paid by said company for the class or kind of work done by me, and not leave the employ of said company or refuse to perform my daily duties without fourteen (14) days notice in writing of such intention to the superintendent, foreman, or the person under whose orders I am employed, previous to the time of leaving or failing to perform my daily duties.

And in consideration as aforesaid, I do further agree that in case I fail to comply with the conditions last aforesaid, that I will forfeit all moneys earned by me and remaining unpaid at the time of such failure on my part to comply with the terms of this contract.

Signed,——————————

Witness.

Although it is possible that this contract may be legally valid under the statutes of Illinois, we doubt whether its terms would receive a rigid interpretation from any court or be enforced through any jury. It is plainly inequitable, inasmuch as it gives to the employer rights which it denies to the employee, and places the latter in a position in which his means of support may be at any moment taken from him without warning, and without leaving him any mode of redress. That this power may be so used as to cause great hardship is clearly obvious, while the system of requiring men not only to give their time and labor, but to bind themselves by such oppressive obligations, for the simple and single consideration of their already faithfully earned wages, seems to us wrongful and highly unjust. "The laborer is worthy of his hire," and although employers have a perfect right to regulate the quantity, quality, and manner of performing his work, they should not take advantage of the necessity which impels a man to toil for the existence of himself and his family, to impose upon him extreme conditions which, were he less dependent, he would unhesitatingly refuse.

We cannot too strongly protest against the adoption of such a method of governing workmen as the above would signify, and we would earnestly advise its discontinuance. It is on such proceedings as this that the harangues of the leaders of strikes and labor uprisings find a substantial basis, which lends to their arguments a weight with men who otherwise would fail to be moved by them. The doubtful benefit, which perhaps may accrue to a single establishment is a hundredfold outbalanced by the obstacles thus thrown in the way of those who are striving to reach a fair and equitable adjustment of the question of labor reform.

It seems to us that the coercion in this case is as evident and in every respect as much to be condemned as that exercised in the contrary direction by the unions. Indeed, if employers adopt this course, with their restrictions on one hand and those of his society on the other, the future of the working man is at best sadly unpromising.

PROPOSED NEW PATENT LAW IN ENGLAND.

A committee of London patent agents has prepared a bill for a new patent law, the passage of which through Parliament is proposed. It is a sort of a patent hash, having been made up, apparently, by means of scissors and paste, its components being derived, in small items, from the patent laws of various countries. It provides that the present set of supernumerary officials, the "Lords and Commissioners," shall still remain in office, to draw their salaries, for that is all they have done or are expected to do. To this gallant body, a corps of six new members are to be added, with salaries varying from $7,500 to $10,000 each.

Some items are then taken from the American law. Examiners are to be appointed, all cases are to be examined as to novelty, and rejections made when the examiner thinks proper. This officer may summon the applicant and compel him to make such amendments as he may require. The present burdensome patent fees are to be retained, while another section provides that the patentee shall be compelled to grant licenses for the use of his invention, on such terms as the examining committee may think proper; and they may also vary or cancel licenses. Issues of infringements are to be determined by a judge, without a jury, who may call in examiners, if he desires, to assist him. Items from the Austrian and continental systems are introduced, requiring that the invention shall be worked within a specific time or the patent rendered invalid.

The grant of patents to the first applicant, whether inventor or introducer, as at present provided, is prohibited, and patents are only to be granted to the inventor or his authorized agent.

The last mentioned clause is the only really sensible improvement that the bill contains. The effect of the other provisions will be to place difficulties and troubles in the way of inventors, without conferring benefit on anybody. We are surprised at the stupidity which this proposed bill exhibits.

What is needed for the encouragement of the useful arts in England, and in every other country, is:

First, the publication in cheap and popular form of the drawings and specifications of all patented inventions, so that the people may become fully informed as to what is doing or has been done in the arts.

Second, the reduction of the fees and the forms for obtaining patents, so that the masses of the people, who are poor, but among whom the real thinkers and inventors are to be found, may readily secure patents for their new ideas.

Third, the placing of the entire control of the patent, from the day of its issue to the close of its term, in the hands of the inventor, to be his property, to be used as he thinks proper, subject to no compulsion or other official interference.

Nearly all of the changes proposed in this bill are steps in a backward direction, not an advance in keeping with the spirit of the age. The present British law is immeasurably superior to this one now proposed. Indeed the existing law is admirable in nearly every respect and works admirably. Almost the only change it needs is a reduction of the enormous patent fees it now requires, and the limitation of the issue of patents to inventors only.

PSEUDO SCIENCE.

We have before referred to the fact that mere reasoning, not based on sufficient observation of Nature, almost always leads to false conclusions and baseless theories, that this was the main fault of the ancient philosophers, and is still the fault of that class of moderns who labor under the serious disadvantage of deficient mental training; we have also asserted that docility to Nature's teachings and a liberal amount of resignation of our own speculative faculties are the real means to come to the knowledge of the truth. Even some of the most eminent men have erred in this way, and are lasting monuments of warning against mere speculation; one such is no less a personage than the famous German philosopher Emanuel Kant, who risked himself on the field of mechanics so far as to write a volume on dynamics, or, rather, on a false imaginary theory of motion, which he calls dynamics. We will only point out a few of his errors:

Kant had evidently never been instructed in regard to the resistance of motion by friction, and he was ignorant of the fact that all motion, once imparted, would continue in the same direction as long as it was not prevented by other causes, of which friction is the most common and, on the surface of our earth, the permanent cause which finally arrests all motion. Having no conception of this, but imagining that force must be a metaphysical immaterial thing which can be communicated to matter, he distinguishes two kinds of force, living force (*vis viva*) and dead force (*vis mortis*), and he illustrates these two forces by the following experiment: "When a book lays on the table," he says, "and I push it forward with my hand so slowly that it stops moving as soon as the contact of my hand ceases, I give it only a dead force; but when moving it with such violence that it continues its motion after the contact of the force-giving hand has ceased, I give it a living force. So a heavy box or trunk, dragged over the floor, is moved by a dead force, but a stone thrown by hand is moved by a living force." He considers that a body, when moving it without contact of a moving force, possesses the force *viva*, the living force; and the conclusions he further arrives at, being based on such false premises, are, of course, totally at fault and contrary to experience and even, we dare say, to common sense.

If Kant had discussed this matter with a good physicist of his time, and obtained some information on the subject of friction, and absorbed this information, in place of exclusively indulging in his own fanciful and groundless speculation, he would never have published his volume on dynamics, which must injure him in the eyes of all impartial investigators. It shows how superficial a thinker Kant was after all; it raises the suspicion that if he was not more correct in his metaphysical reasonings than in his plain physics, he does not deserve the confidence of his readers, and his conclusions may go for naught.

Another illustration of a similar nature is Goethe, who in the latter years of his life had a notion to study optics, and wrote a volume on light and colors, in which he proves that he had not the least capability of making experiments, and was still more deficient in his powers of observation. His conclusions are almost all false; he is perhaps worse than

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Kant, and his book is nothing but a confession of deficient judgment in regard to experiments and defective training, his education being, as is well known, exclusively literary.

As there is no more useful labor than opening the eyes of people to the truth and rooting out their prejudices, we consider it a necessary and progressive step to tear away a portion of the halo which surrounds certain names, and which has almost become to mankind sacred, owing to the habit men have of regarding their heroes as superior in all respects to the ordinary run of humanity.

LENS FIRES.

Dr. H. C. Bolton, of Columbia College, New York city, states that on a recent occasion, at 9 A. M., on entering his laboratory he found a wooden table on fire, ignition having been occasioned by the rays of the morning sun, which fell upon a glass spherical flask containing water. The flask served as a lens which concentrated the rays and set fire to the wood. The author also alludes to the statement of Lactantius (A. D. 300) who mentions the use of glass globes, filled with water, to be used in kindling fires; while Pliny recommends the use of lenses for the purpose of cauterizing the flesh of sick persons. As to the latter, one Mr. Barnes, of Connecticut, took a patent in this country some five years ago for the use of lenses for the purpose suggested by Pliny.

In respect to fires occasioned by lenses, doubtless there are many examples. It is well known that vessels at sea have been set on fire by the bullseye glasses used to admit light to between decks. These glasses were formerly made convex on one side, thus forming powerful lenses. In consequence of the loss of property and danger their use has been discontinued, and thick plates of glass, flat on both sides, have been generally substituted.

Captain Scoresby and Dr. Kane used to astonish the natives of the polar regions by taking blocks of clear ice and cutting them into the form of lenses, with which they instantly kindled fires.

CURIOUS EFFECT OF LIGHT ON SELENIUM.

Selenium is a substance that resembles and is allied to sulphur. It is found in connection with some natural deposits of sulphur, but it more commonly occurs in combination with metals, forming selenides. Selenium is less combustible than sulphur, burns with a blue flame, and emits a putrid horse-radish odor.

Mr. Willoughby Smith has been making a series of electrical experiments with selenium, and, at a recent meeting of the Society of Telegraph Engineers, London, he made known the following remarkable results:

The sticks of selenium were connected with platinum wire and hermetically sealed in glass tubes. The electrical resistance of some of the sticks was very great, others much less, and he was at a loss to account for this lack of constancy, until, after various trials, he found that it was due to the action of light. When the sticks of selenium were shut up in a box so as to exclude light, the electrical resistance was highest and remained constant; but when the cover was withdrawn and light was allowed to fall on the sticks, the electrical resistance diminished 15 to 100 per cent, according to the intensity of the light. The shading of the selenium by means of glass plates of different colors showed that the conductivity was altered in proportion to the interception of the light. These are very singular observations, and may lead to new and useful discoveries concerning the qualities of other substances, and the manner in which light and electricity affect them.

THE SIPHON RECORDING TELEGRAPH INSTRUMENT.

Perhaps the most valuable inventions in connection with submarine telegraphy have been made by Professor William Thomson. During the laying of the Atlantic cable, the services of Thomson's reflecting galvanometer were most valuable, but lately he has succeeded in perfecting a recording instrument which is worthy of description. The instrument in question is in use at Duxbury, operating through the French Atlantic cable. It is available for recording a positive and a negative current upon a strip of paper in the long and short signals of which the Morse alphabet is composed. The difficulty of producing such a recorder as this has been due to the difficulty of obtaining marks from a very light body in rapid motion without impeding that motion. To effect this, the inventor connects (either by direct attachment or by stretched thread or fiber), to the body moved by the received current, a light marking needle or tube, from the end of which ink or other fluid is spirted upon paper. The signals which are to be recorded give rise to motions of the marking end which are parallel to the plane of the paper, while the paper is drawn along its own plane and in a direct perpendicular to the line of the motions caused by signals. Sir William Thomson employs for the marking needle, by preference, a capillary tube, or a bristle dipping at one end into a stationary reservoir of ink or other fluid; and he causes such fluid to be spirted or drawn from the opposite end of the tube by means of an electric force, or by means of rapid vibrations maintained in the needle or in the paper, in a direct perpendicular to the plane of the paper. These vibrations may be maintained mechanically or pneumatically as by the agency of sound, so that the paper receives ink by a succession of fine contacts, between each of which the tube or bristle is quite free to move. When the electric method is used, the paper is drawn over a metal plate electrified, say, positively, the capillary tube being electrified negatively; and a powerful difference (potential) is maintained between the tube and the metal plate, such as would tend to cause a succession of sparks to pass between them and which, under the circumstances, produce a fine stream of ink, or a succession of fine dots, spirted from the tube on to the paper, leaving a record of the position of the tube at each instant and drawing a continuous line on the paper, without impeding by friction the motion of the tube as directed by the receiving instrument. It has been found most convenient to allow the paper to move in a vertical plane, and to use a small glass siphon with its short leg dipping in the ink and its long leg pointing obliquely downward at the paper and close to it. The receiving instrument used in connection with this marking apparatus is a peculiar arrangement in which the received current passes through a very light coil of a small number of fine wires. Part of this coil is placed in a powerful magnetic field produced by permanent magnets or by electo-magnets, which set with great force upon the coil when the current passes through it. The coil is kept stiff without any complete framework or bobbin, by the use of stiff pieces or booms, drawn asunder by threads or strong fibers stretched to fixed points and serving to support the coil while giving it the requisite freedom to move and the needful stability. The message recorded by the ingenious apparatus appears like a continuous line; but when examined closely, it is found to be made up of a series of ink dots. The line made in a longitudinal direction corresponds to spaces in the Morse alphabet made by heading the current; and the to and fro transverse lines, which may be long or short as the cable current varies in strength, accomplish the same purpose as the dot lines made by the Morse pen. Thus the swinging motion of a delicate coil is perfectly recorded with minimum expenditure of force. Sir William Thomson has accomplished what has been hitherto deemed an impossibility.

THE VIENNA EXHIBITION.

On Saturday, March 15, General Van Buren, with his family, left for Vienna to take charge of the United States Department of the great exhibition. The appropriation by Congress of $200,000 and two vessels for the free transportation of merchandise has enabled the Commissioner to collect a large number of articles for the great show, notwithstanding the unprotective nature of the Austrian patent laws. Most of the exhibitors are manufacturers whose wares are well known here, and whose inventions have been so long in public use that the patent laws of no foreign country would probably afford them protection.

Had the Austrian Government amended their patent laws so as to afford the protection that the word "patent" implies, a larger number of our more recent and important inventions would have found place in the American department. If our part of the show does not compare favorably with other nations, it should be ascribed to the unwillingness of American inventors to trust their novelties to Austria's tender mercies.

The ship Supply completed her cargo and sailed for Trieste a fortnight ago, and the ship Guard will sail, with the last of the goods for the exhibition, on March 20. Both are sailing vessels, and it is therefore uncertain when they will reach their destination: in season, however, it is hoped, to permit their freight to reach Vienna before the opening of the exhibition May 1st. About the same class of articles will be found in the American wing of the Austrian show as is seen year after year at the Fair of the American Institute. Among the most prominent are sewing machines of great variety, the contributions of the Singer Sewing Machine Company alone amounting to one hundred cases. Then there are knitting machines, scroll saws, wood working machines, windmills, pumps, steam engines, water wheels, safes, pianos, school furniture, etc., besides ores, bales of cotton, hemp and other products from various parts of the country, representing the growth and industries of the sections from which they come.

On the main floor of the American department will be shown, in actual operation, shoemaking, bucket, brush, and nail making machines, stone breaking tools, flax cleaning machinery, rock drills, circular looms, machines for making pipe elbows, boot heeling machines, and numerous kinds of wood working machines. General Newton has sent a perfect model of the engineering works now carried on under his direction at Hallett's Point, and the United States Lighthouse Board has forwarded their best specimens of lighthouse lanterns, and the Navy Department their new improved apparatus for hoisting and lowering boats.

About seven hundred exhibitors have space assigned to them, and some who were unprepared to send by the government ships will forward their goods at their own expense by steamer. Commissioner Van Buren has been untiring in his efforts to have our country represented, and it is believed that the American department of the Vienna exhibition will be creditable to the nation.

THE DETROIT RIVER TUNNELS.

We regret to learn that work upon this great enterprise has been indefinitely suspended, for lack of funds, and the expected union of Canada and the United States, by the bonds of an underground railway, is for the present abandoned. This is a great pity, especially as much work had already been done. The original plan contemplated the connection of the Great Western Railway of Canada with the Michigan Central Railway, at Detroit, Mich., by means of two independent circular tunnels of masonry, each 15 feet in diameter, executed by borings under the bed of the river. Each tunnel was to have been 8,568 feet in length.

The preliminary work consisted in drifting a small tunnel 5 feet in diameter, intended as a drain for the two larger works, and it is upon this small tunnel that considerable labor has been expended. Headings were made on both sides of the river, and, up to a recent date when orders were given to stop, these headings had been carried 1,709 feet in all, or 1,220 feet on the American side and 480 feet on the Canadian side.

Mr. D. D. McBean, Superintendent of the works, has published, in a recent number of the Detroit *Post*, an interesting review of the practical operations so far as they were carried, showing that the works might be easily completed if the money were forthcoming. We hope that an improvement in the exchequers of the companies concerned will enable them hereafter to proceed with the works and bring them to completion.

SCIENTIFIC AND PRACTICAL INFORMATION.

BLEACHING BY TURPENTINE.

It is well known that turpentine generates ozone, and the fact has been used for bleaching purposes. The turpentine is violently whipped by dashers and the ozone is blown from the generator into the vat containing the paper stock or other goods to be bleached. How far this operation is successful we do not know, and only throw out the suggestion for some one to give it a trial and report the result.

HARDENING BURNED STEEL.

For hardening the steel points of tools of boring machines, etc., when burnt, J. Jossi proposes the following method: 10 parts of tallow, 2 parts horn filings, 1 part sal ammoniac, 1 part pulverized charcoal, and 1 part soda are mixed together and placed with a piece of wood on the parts to be hardened, after they have been exposed to a cherry-red heat. The mixture dries under the influence of the heat, and the steel parts may then be hardened again in the usual manner.

ARTIFICIAL MILK FOR CALVES.

Successful experiments have been made in raising calves by means of a soup or milk prepared according to the recipe of Baron Liebig, which is as follows:

Seven pints of water and three and a half pints of milk are boiled with 10 ounces of wheat flour to an ordinary pap; three and a half more pints of milk are then added, with an ounce and a quarter of a potash solution consisting of two parts of bicarbonate of potash dissolved in 11 parts of water. The same quantity of bruised malt as of wheat flour is added to the hot pap, which is well stirred and allowed to settle for half an hour near the stove or other warm place, when it is boiled again and filtered through suitable gauze.

The calves are fed for about 6 weeks on pure milk, and gradually they are allowed less, some of the substitute being added. At last they are given about 7 quarts of artificial milk per day and no pure milk. After three months, only one half of this quantity is given, half a pound of linseed cake being added; in the fall some boiled potatoes are mixed in. The calves gain about two pounds in weight per day. A calf which was weaned on February 22 gained on an average 2·12 pounds per day. Should calves dislike to take the milk of the cow, the substitute is given immediately. No disadvantageous effects of feeding with this milk were observed. Diarrhœa did not occur at all. The milk was also applied to the raising of pigs, and was in their case useful in the cure of diarrhœa, which so often fatally attacks them.

NEW METHOD OF CLEANING GLASSWARE.

Dr. Walz sends us the following correct description of his new method of cleaning glassware, published on page 151 of our current volume: The vessel to be cleaned is filled, or, if large, rinsed with a moderately dilute solution of potassium permanganate, the contact of the liquid being prolonged till a film of hydrated manganic oxide has been deposited; the solution is then poured away, and the glass vessel rinsed with some strong hydrochloric acid. Chlorine is then formed, but not enough to cause inconvenience; and acting in the nascent state on the organic matters, it speedily converts them into substitution products, which are soluble in the slight excess of acid or water.

PRESENCE OF SILVER IN SUBNITRATE OF BISMUTH.

M. Ch. Ekin observes that this preparation often contains silver, of which, however, no notice is taken in most works on pharmacy. Having tested it for the purpose of detecting a silver compound (subchloride), he found some samples of the subnitrate to contain from 3·9 to 6·5 per cent of subchloride of silver; and in other samples he found metallic silver, but in small quantity.

KIRCHER'S REMARKABLE OBSERVATIONS CONCERNING THE SUN.

The great English philosopher Isaac Newton, and, in fact, all the astronomers from the middle ages down to the end of the last century, had a much more correct idea of the nature of the sun than was the case with William Herschel and his followers, who, in order to keep step with the current of public opinion of their time (which favored a plurality of inhabited worlds), tried to prove not only all the planets but even the sun itself inhabitable, at any cost, even at the expense of common sense. For that purpose Herschel invented the phosphorescent cool atmosphere which, from its under surface, gave only sufficient light and comfortable heat to the inhabitants on the solar surface, but from its upper surface projected radiations which, at a distance of over 92,000,000 miles, could develope, with the help of our atmosphere, the burning heat of our tropical zones. Notwithstanding that the idea was absurd in the extreme, and without any foundation on analogous facts positively known about the properties of matter and of heat, it was accepted on the authority of the oder Herschel, who (when we render him impartial justice) must be considered as only a successful telescope maker, and a very poor philosopher. This absurd doctrine about the nature of the sun is, even now-a-days, not expunged from our school books on astronomy,

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many of which still contain the following sentence: "The sun is a dark body surrounded by a luminous atmosphere."

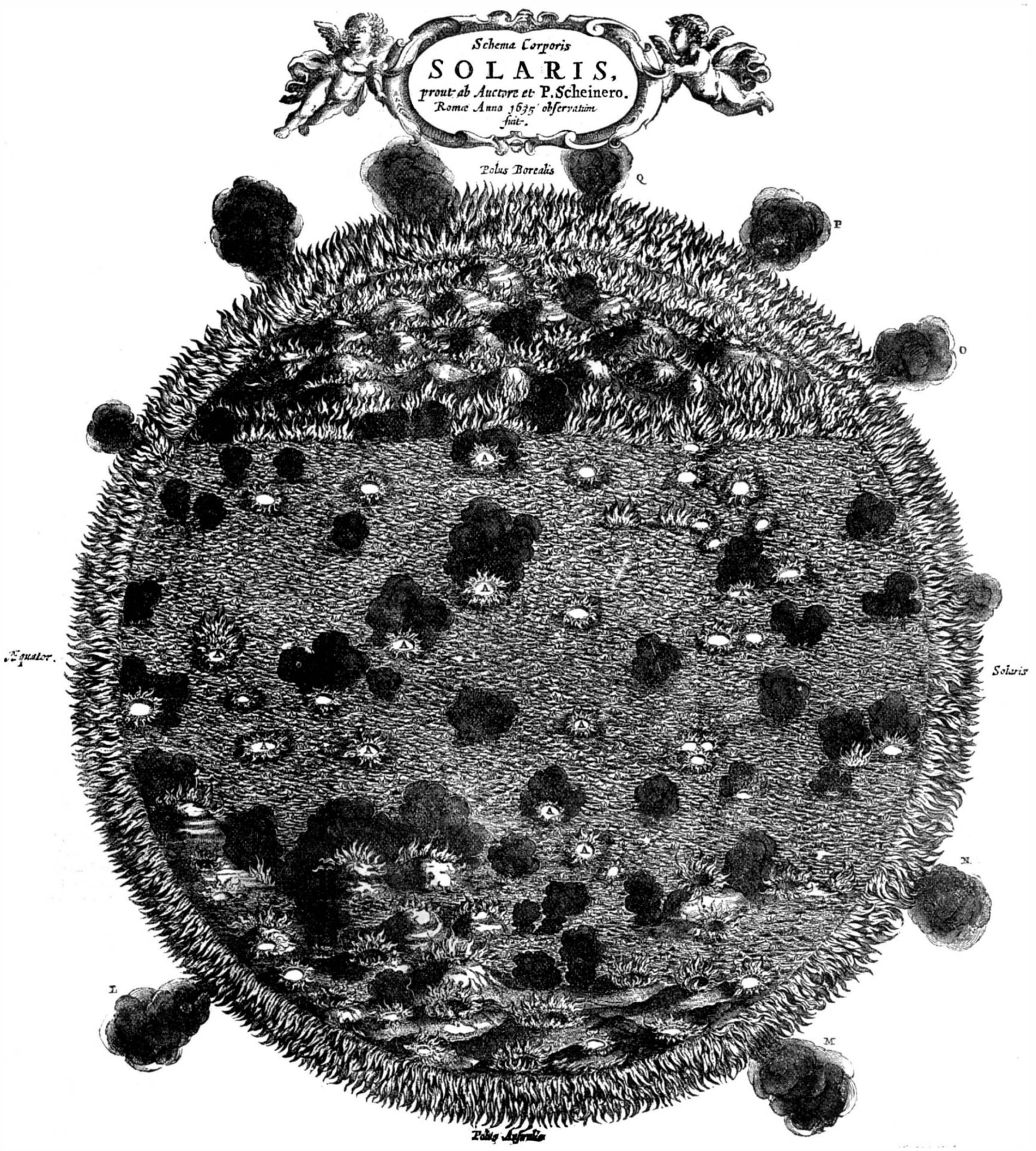
Thanks to the revelations of the spectroscope, we know now that Isaac Newton was perfectly right when he estimated the temperature of the solar body to be many thousands of degrees. It is, in fact, so high that, according to his statements, we, with our most intense fires, cannot form any adequate conception of the same.

As a proof of the correctness of our assertion as to the opinions in regard to the nature of the sun, during the century preceding Newton, we publish herewith a reproduction of an engraving made more than two hundred years ago in a cosmographic work, written in Latin by Father A. Kircher, and published in Amsterdam, Holland, where a translation of this book into the Dutch language appeared in 1682. It consists of two folio volumes, and is illustrated by many woodcuts and engravings on copperplate. The work is, as all works of that time were, a curious mixture of truth and untruth, filling the reader, in succession, with admiration at the patience and sound judgment of the author and then with surprise at his credulity in recording evident errors as positive facts. The article on the sun, explanatory of the engraving which we reproduce, is one of the remarkable instances in which the author is on the side of the truth, and he even anticipates the modern ideas resulting from discoveries of two centuries later. We can only give an abbreviated translation as, like all old writings, it is too long winded for readers of the 19th century. He says, in substance:

"The great and good Architect of the universe, has given us an image of His Divinity in a body which causes all life, motion, and being, the sun, which (as a soul or mind of the universe) is, in the material world, the visible representative of the invisible God; by it He created light and order out of darkness and chaos, and revealed to man the majesty of the invisible power to which he owes his very existence."

. . . "Notwithstanding that we see the sun daily, we must be amazed at its beauty, and notwithstanding that it is given to no man to obtain a correct knowledge of its nature, the question arises: What does that glowing substance consist of? To this I answer that *the sun is a fiery body condensed from a heavenly vapor*, out of which heat and light flow off to all things, as out of an inexhaustible fountain of fire; which heat and light, combined with the seeds of the earth, produce the wonderful variety of things which we daily see here below. The sun, then, *is a sphere, rough and uneven, consisting partially of liquid and solid matter*, which would appear incredible, if it had not been proved by the very excellent magnifying spyglasses, invented for the inspection of the stars. If such a glass is attached to the hole in a blind of a dark room, and turned toward the sun, an image of the same may be thrown on a white sheet; it will be seen that the surface of the sun is uneven, has shadows and lights, and is rough like the waves of an ocean, and that it varies and is not today as it was yesterday. All of which has been described by the celebrated Scheinerus. Sometimes also large spots, some of them dark, and some light, are seen, which last several days, sometimes disappear and reappear again after some days; these spots are especially seen at certain positions of the stars. All who have ever seen the large crucibles for the melting of metals, and noticed the surface of the white hot metal and the motions on its surface, can form a better idea of the appearance of the surface of the sun, whence sometimes smoke arises, as I have seen myself in Rome with Scheinerus, on the 4th of April, 1625, wherefore I have judged it appropriate to add here a picture of what I saw. That these images of shadows and *faculæ* belong to the solar surface is evident from common reason. We must then conclude that the sun is a heterogeneous fiery region, where changing spots, smoke, and *nebulæ* arise from the surface, now boiling up, then again disappearing, as in a fiery ocean agitated by constant motions and drift currents. All those who will further investigate these wonders of the sun will, without doubt, easily understand the origin of the comets." . . . . . "In order that the sun should better give its wonderful power to the other heavenly bodies, the Architect of Nature made it turn around on its axis, as recently demonstrated by the astronomers; while the earth is provided with a vapor region made from the evaporations from our earth, the rising of which moderates the too great heat of the sun, so as to give us a moderate amount."

We will not follow our author, the Reverend Father Kircher, any further, but only remark that his picture shows the dark sun spots, and the *faculæ*, marked A; the poles and equator are also indicated, by the Latin names; while however, the most remarkable of all are the protuberances, marked L M N O P Q R S T. It is not a little noticeable that he introduced them in the picture nearly two hundred and fifty years before the instruments, which proved their real existence beyond a doubt, were invented. On the whole we consider this picture as a very remarkable production for that time, in which even an attempt had been made to represent the so called willow leaf appearance of the solar surface, a discovery of modern astronomers, the production of which in so old a record of observation is, to say the least, a remarkable coincidence.



APPEARANCE OF THE SUN AS DRAWN BY FATHER KIRCHER IN 1682.

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Correspondence.

Distinguishing Fibers in Mixed Goods.

To the Editor of the Scientific American:

Unquestionably the microscope is the best means of accomplishing the purpose of your correspondent, described on page 161 of this volume; it is the simplest, quickest, easiest and surest. All and each of the fibers named in the article are constructed—built up, so to speak—in different manners, so distinct from each other that a moderate magnifying power, say 400 diameters, of a decently good instrument will show at once what they are. Any one with a very little skill in manipulation can obtain the result. The differences have been described and figured in the books, but there is no need of books. Every one can obtain genuine fibers of either kind, with almost less trouble than referring to a book, for comparison with those found in the fabric, and the original comparison is of far more value than the authority of a picture. No chemical test is known to distinguish flax from cotton fiber, but their difference in the microscope may be seen at a glance. Jute fiber has more resemblance to flax, but can be distinguished with a little more study. The materials of paper may also be ascertained, in part at least, by the microscope; for example, your number dated March 15, is printed on paper containg no cotton or linen; it is mostly wood fiber with "pitted" and "scalariform" ducts, not peculiar to any kind of wood, with possibly fibers of manilla, esparto or ramie, of which I have not the means of comparison.

But the microscope cannot do every thing. There is a certain fabric in use purporting to be made entirely of cows' hair. The question came up: Is there any sheep wool in it? This could not be answered. For, while the bulk of each is easily distinguished, there are some hairs from each animal that cannot be known from the other. In this case, so far as is known, chemistry is equally powerless.

Boston, Mass. CHARLES STODDER.

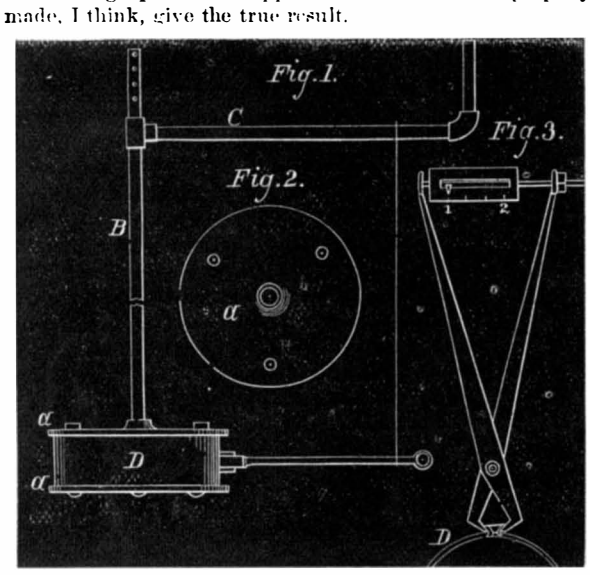
Bursting Strains of Cylindrical Boilers.

To the Editor of the Scientific American:

In the discussion of the boiler question in your issue of February 22, Mr. Creuzbaur is trying to show that there is no force tending to tear the shell at X X (in the diagram), except a vertical one, so long as the points remain the same distance apart, etc. Now they would not long remain the same distance apart, if something did not hold them there; and the very force which would spread them is what makes the extra strain that he overlooks.

But in all the diagrams the matter is placed in a false light. In a boiler the force is acting in all directions from center to circumference, where it is changed to the direction of the circumference. It evidently bears some relation to the force acting in the former direction. Now let us see what that relation is. The force acting from center to circumference tends to enlarge the diameter, and the shell or circumference resists that enlargement. As I said in a former communication, to enlarge the diameter 1, the circumference must be enlarged 3·1416; therefore the whole pressure in the ring (any width) is to that tending to separate the iron at any and every point as 3·1416 is to 1; for we cannot ignore the very foundation law of mechanics, that what we gain in velocity we lose in power, and *vice versâ*.

I think if any one has the desire to try an experiment and make known the results, it might be of much benefit to many, and perhaps lessen the number of boiler explosions. I inclose a rough plan of an apparatus which would if properly made, I think, give the true result.



The dimensions I give are, of course, not arbitrary; a machine of much larger dimensions would reduce the friction to a minimum, and give more accurate results.

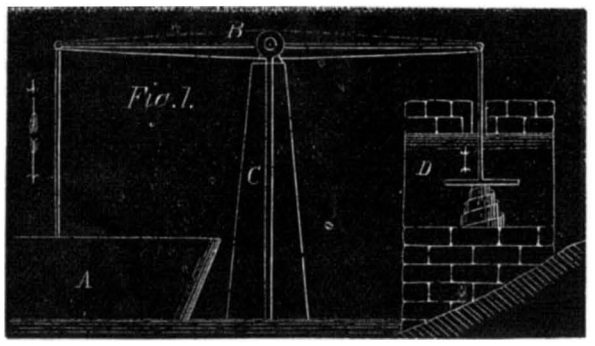
In Fig. 1 (elevation), *a a* are two metal disks, say a little more than 7 inches in diameter, faced true and smooth in the inside for about 1¼ inches from the outer edge; they are held 1 inch apart by three thimbles and bolts, as shown. B is a gas pipe 1 inch in diameter, with a line of holes at one end; a convenient length for the pipe would be about 27¼ inches to the first hole, which is the hight corresponding to 1 lb. of water. C is a feed pipe for filling B with water, which enters at the side to do away with the impact that would arise if the water entered the top of the pipe. D is a light metal strap or band, 1 inch wide and a little more than 22 inches long, bent into a ring, with two small lugs soldered on near each end, so that, when they are brought together the ends will overlap a little, making the ring 22 inches in circumference. These are to be held together by a nicely made double lever or tongs, Fig. 3. The tongs are to gripe the lugs close to the band, as shown. Let the two ends of the levers be proportioned as 1 to 7; put in a spring index between the long ends. as shown; screw it up to 1 lb., then the other end will be brought together with a force of 7 lbs. The levers with the index can be suspended from the feed pipe. The band, D, must be nicely fitted between the disks, so that it will move without friction, and a slight leak will not affect the result. The thimbles should be set near the inside of the band, so as to keep it in place. Now let water flow out of the feed pipe and fill the pipe, B, up to the first hole; and, if my theory be right, a little above that will move the index. By carrying the pipes high enough, or by re-adjusting the index, the true relation can be ascertained. C. P. EVERED.

Montgomery city, Mo.

The Ocean Tides as a Prime Motor.

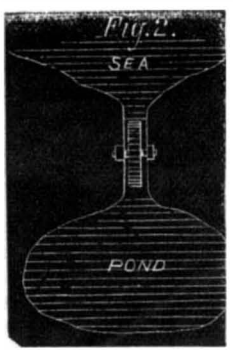
To the Editor of the Scientific American:

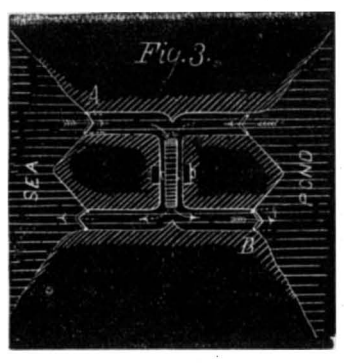
In an article on page 64 of the current volume of the SCIENTIFIC AMERICAN, "The ocean tides as a prime motor," you describe the enormous power of the tides, adding the remark that to utilize it constitutes a problem for the engineers of the future. I wish to communicate to you two methods to accomplish said purpose, which have been introduced and have, in some degree, been deemed satisfactory. The first is as follows (see Fig. 1):



The tide lifts the float, A, from which power is transmitted by means of the beam, B, pivoted on vertical standards, C, to the building or pillar, D. The power may be applied directly or, as has been proposed by some engineers, transferred to strong spiral springs, which may be secured in place and carried to the required situation for use at a distance.

Another method is the following (Fig. 2): A pond is built near the coast and is connected by a canal with the sea. An undershot water wheel is placed in the canal. The rising tide will turn the lower part of the wheel toward the pond, the falling tide towards the sea; because the level of the sea was higher than the pond in the first place, and lower in the second. This necessitates a peculiar construction of the wheel, as the paddles have to be placed radially, and a gear for reversing the direction of the power is required. To avoid this, the following construction was used (Fig. 3): Two parallel canals were made to connect the pond and the sea, and the wheel was placed in a third one, connecting the two others. The mill was erected on the islands formed by the canals. Four sluices, two for each canal, were built, the sluices of one opening towards the inside, those of the other towards the outside. The flood tide opened the sluice, A, at one end, holding it open, and it closed the other end and enter the pond through the lateral canal and sluice, B. moving the undershot wheel in the direction from the first to the second canal.





The ebb tide returned by opening sluice A, passing in the same direction through the connecting canal and through B to the ocean, turning the water wheel in the same manner as the flood tide did. This system requires only four well acting locks, which may be easily obtained by constructing a proportionately large pond. E. & E. S. EDWARD.

Dresden, Germany.

Psychic Force on the Slate.

To the Editor of the Scientific American:

I wish to invite the attention of scientific men to the phenomenon called spiritualism, as it has lately been developed here. Although somewhat ridiculous, yet it is wonderful; and if intelligent people will investigate it thoroughly, and discover the source of the mysterious power which some mediums possess, they will confer a boon upon mankind. I am not credulous, I do not believe it to be spirits, but I am at a loss to explain it. I will describe the apparatus so that all may experiment, but I understand that the medium power is possessed by but few; yet the reader of this, or perhaps some of his friends, may possess the power. Try it.

Cover a table with some fabric that will exclude the light from underneath, as it seems that darkness is necessary to success. Then provide an ordinary school slate with a lot of short pencils. Place a chair so that you can hold the slate under the table. Take the slate in one hand, hold it by the frame horizontally under the table. After having placed a piece of pencil on the slate, be sure the curtain is down to exclude the light. If you possess the medium power it will soon make itself evident by raps, or you will hear the piece of pencil fall on the floor, sometimes striking the table violently. When the pencil falls, replace it with another. If there is any demonstration, ask if there is a spirit present; if so, make it known by rapping on the slate. Three taps signify "yes;" two, "no;" one, "don't know." If the answer is yes, ask if it can write. If yes, then ask any question you wish and an answer will be written on the bottom of the slate; the pencil falls as soon as it has done writing. You can distinctly hear it writing, dotting the i's and crossing the t's. I have seen the above performance and have been allowed to hold one corner of the slate, and could detect nothing unfair on the part of the medium. I have held his arm just below the elbow, where I could detect the slightest movement of the fingers, and could discover none except when the pencils would fly violently off; then there was a slight twitch of one of the muscles, but I cannot see any possible way for that to be fraud. We guarded against everything in the way of fraud. Place a piece of pencil on a slate and hold it horizontally in one hand and try to throw it upwards without much effort.

Now the problem is: how is the writing done? If you have never seen this mystery, I advise you to do so and satisfy yourself before you express an opinion. The whole thing is ridiculous, I must confess, but the charm is the mystery, and the wonderful writing is in different styles of penmanship. If a lady spirit writes, the writing is peculiarly correct, punctuated, etc. Each individual spirit writes in its own peculiar hand writing, differing from others as we mortals differ in our writing. I could continue this communication to some length, but my object is not to relate my experiments but to have others experiment for themselves.

Chattanooga, Tenn. S. C. DODGE.

The Recent Boiler Explosion at Conshohocken.

To the Editor of the Scientific American:

In your issue of March 8, 1873, Messrs. I. Wood & Brother, of Conshohocken, Pa., publish a communication in which they seem to feel aggrieved that I should have spoken freely regarding the lamentable loss of life by the explosion of their boiler. It is of course exceedingly unpleasant to state the truth about a matter of this kind. I know that Messrs. Wood are exceedingly honorable men and would in no wise be guilty of doing ought that would imperil the lives of their fellow citizens or their employees. My motive was not to make an attack upon Messrs. Wood, or to accuse them of culpable carelessness, or to speak of them disrespectfully. It was only to call attention to the circumstances under which this boiler exploded, in order that men who employ similar means and appliances for power might not do as they have done.

In their communication to your paper, they claim that the boiler was good because it was old, and that it had had steam on it and been in use since 1854, a period of nearly 20 years. I do not think that a boiler is, like wine, improved by age. My experience tells me that no boiler should ever be in use more than ten years.

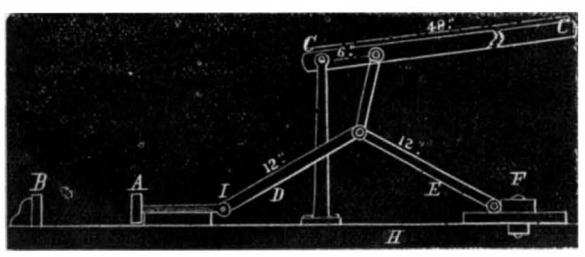
Messrs. Wood state that there was no steam gage attached to the boiler, it having been shut off for repairs. I do not think there is a mechanical engineer in the civilized world who would expect that a boiler nearly 20 years of age, with no steam gage upon it, would indicate pressure to the eye of the man attending it. I do not think that any cultivated engineer of experience could be found who would not most emphatically say that there was danger that the boiler of the Messrs. Wood would explode. W. BARNET LE VAN.

Philadelphia, Pa.

The Power of Compound Levers.

To the Editor of the Scientific American:

I would like to know what force one pound at the end of the lever, C, would exert on an object between the stationary block, B, and the sliding head, A, when the arms, D and E, are nearly straight, or are exerting their greatest force. The lever, C, is 48 inches; the fulcrum is at G, and the connecting arm is 6 inches long. The arms, D and E, are, 2 inches long, and E is stationary at F, on the bed plate, H, and D is connected at I with the sliding head, A. J. C. C.



Morenci, Mich.

REMARKS BY THE EDITOR:—The relation of the effort exerted to the resistance which can be overcome, varies with every change of position of the lever, up to a power which would break down any machine built of inelastic materials. See our reply to A. B., in the SCIENTIFIC AMERICAN of March 8, 1873.

Ignition by Superheated Steam.

To the Editor of the Scientific American:

In my communication published in your paper of February 8, I endeavored to lay before your readers some facts in regard to the use of superheated steam and its relation to fires.

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I attempted to give a faithful statement of all the facts bearing upon that subject, and I am glad to see any corrections or additions which may be made to the same. The further light Mr. Miller (in your issue of the 8th instant) throws upon the subject is worth consideration. He points out that the lagging was well saturated with linseed oil, and that even some oil from greasy waste may have reached the felting. The engine had run for nearly a year, certainly for some weeks, with about the same quantity of oil in its lagging and felting, with no signs of fire or smoke, while six hours with the Miller boiler sufficed to set it on fire. The steam pipe of which Mr. Miller speaks was wound with yarn and felting, and covered with whitewashed canvas as far as the engine room, say within 18 or 20 feet of the throttle valves. Within the engine room it was first covered with a thickness of felting, and over that were the pine ribs to which the lagging was fastened; while, about the engine, the pine ribs were in contact with the metal. It is also to be observed that the close covering of a symmetrical pipe would prevent any circulation of air about the felting, while the lagging about the throttle valves was quite imperfect, especially at the bottom. Whether superheated steam, rather than ordinary saturated steam, caused this fire or even had anything to do with it is what we are endeavoring to discover. The conditions were in all probability the same, and what those conditions were I have endeavored to state; I have studiously avoided doing more than that.

And here it seems to me that Mr. Miller ought to have rested. Why he should pull the subject out of its legitimate bearings, I can hardly understand. If he chooses to set forth in your columns the superiority of his boiler over others, or the value of superheated steam, I can have no objection thereto, but I do protest against his using a report not his own, without the consent or knowledge of its owners, to further that object. Those experiments, Mr. Editor, were incomplete. The Miller boiler was in use but six hours, and other considerations had led us to refrain from publishing the report in order that the engineering and manufacturing community might not be misled by partial reports. Whenever we can speak intelligently and sincerely of the superiority of the Miller boiler, we shall gladly do so; but the report which Mr. Miller sent you has but little value in deciding that question.

A. F. NAGLE,
Providence Water Works. Mechanical Engineer.

The Nebular Theory and an Inquiry into the Reason of Kepler's Harmonic Law.

To the Editor of the Scientific American:

Having long been an interested reader of your valuable journal, and for many years devoted to astronomical study, I would beg a small space in your columns, in order to give what I think may be some reasons for a belief in the relations which may exist between what is known as the nebular theory and one of the laws of Kepler, known as his third, or harmonic, law.

In considering the nebular theory we are led to presume that the sun, as a gaseous body, may at one time have extended even beyond the present bounds of the orbit of the planet Neptune; and that other planets revolving far beyond his orbit, as yet undiscovered by our present telescopes, may have been first thrown off from the solar nebula during the earlier births in the family of our solar system. Be this as it may, we are acquainted with a sufficient number of the members of that family to answer our present purpose. According to the nebular theory, the solar system, including the sun, planets, planetoids and comets, originally existed in one body in a gaseous state, similar to the planetary nebula and extending at least beyond the orbit of Neptune, and perhaps much further, if we take into account some of the comets of long period. This gaseous body must have been very highly heated in order to maintain the more refractory substances in such gaseous condition. And, judging from our present knowledge, a portion of this heat would be subject to a continual diminution from the radiation of heat in space. A necessary consequence of this loss of heat would be a corresponding contraction of the gaseous body, and an acceleration in the axial rotation. And as the exterior, or outlying, portions of this gas would be more mobile, less under the influence of gravitation, and would less readily obey the tendency to accelerated rotation, a condition would eventually arise in which the tangential or centripetal force would become equal to the central or gravitating force. This condition once attained and the contraction of the central mass still continuing, such outlying portion would become detached and, possessing the tangential motion of the equatorial portion of the remainder of the mass, would start out on its orbit in the same direction and continue to revolve around such remaining mass as a planet. This planet, still remaining in a gaseous state, would be subject to the same conditions as the parent mass; receiving an axial rotation, taking upon itself the form of an oblate spheroid, obeying the law of gravitation, parting with a portion of its heat, undergoing contraction, and increasing in its axial velocity, until finally this same planet would, in a similar manner, give birth to a secondary planet, or satellite. This process would continue in both solar and planetary masses, so long as their external portions should be sufficiently mobile and the force of gravity overcome by the tangential force. Astronomical science contributes much evidence tending to show that our whole solar system has thus been evolved from matter once in a nebulous condition.

At first sight, the ring of Saturn might appear to form an exception to the above theory; but if we consider that, in that case the outlying enveloping portion, when detached, might have been much more uniformly distributed around that planet's equator; and thus continue to remain unbroken, subject, perhaps, at some future time, to be again subdivided into innumerable small satellites. What gives additional strength to this theory is the fact that these planets and satellites continue to move in an orbit around the equator of their parent, or very nearly so, and that is precisely the place, owing to the greater tangential force and the smaller amount of gravitation, from which such detachments should be expected to take place.

In seeking for a sufficient reason for the existence of Kepler's harmonic law, we have only to consider that it will be evident that, after the solar mass had parted with its loose outlying portion, it would be likely to be some time before it would again have contracted sufficiently to repeat the operation, especially if these detachments were assisted by some eruptive force, such as we find to be still existing in the sun. The contraction might be tolerably uniform, but, the detachments being in masses, would only take place as at so many successive stages. At each of these stages the tangential velocity would be greater than at the preceding stage, precisely as these orbital velocity of the planets and satellites increases in a certain ratio as they are near to the sun. We may note also in passing that these orbital velocities are in proportion to the masses and distances of their respective primaries.

Considering that there has been the same constant relation between solar matter and the forces (to which it has been subject from the earliest to the present condition of the sun) throwing off these detached masses at different stages of contraction, at tolerably related intervals, and at decreasing distances from the center of the mass: can there be any difficulty in accounting for the existence of Kepler's harmonic law? The question may be asked: Why has not the sun thrown off any other planet after Mercury, or Vulcan, if any such planet exists? To this it may be replied, that, as the central mass continued to contract, its density would continue to increase, a time would arrive when the tangential and eruptive forces combined would be insufficient to overcome the central or gravitating force, and, consequently, no more matter would be thrown off. Astronomers believe that that time arrived long ago, perhaps millions of years.

The spectroscope reveals the fact that the planetary bodies are composed of the same elements as the sun itself. Astronomers now generally believe that our moon has lost nearly all of its radiant heat. As her mass is only about one eightieth of that of the earth, it is no wonder that she should have cooled so much faster than our globe has. The masses of Jupiter and Saturn also, being much greater, will account for their cooling more slowly than the earth, and retaining to the present time more of their heat and gaseous condition, giving light to their satellites in addition to that which the latter derive from the sun. This condition of those planets will also account for the change of form which they have been seen to undergo, which could not happen were they as dense and as rigid as the earth now is. The later discoveries in astronomical science appear to contribute more and more evidence tending to confirm the nebular theory.

I know not whether it is yet an ascertained fact that the sun is still contracting from loss of radiant heat, but I firmly believe that, if not, it will be demonstrated in the future, when sufficient time has elapsed to make a comparison between the sun's distance and apparent diameter at one epoch with the same elements at another epoch.

To conclude, the science of astronomy is destined, in the future, to engage the highest intellects, and to command the exercise of the most abstruse methods of investigation and calculation.

E. H. PRICE, M. D.
Tamaroa, Ill.

The Duplex Telegraph Instrument.

To the Editor of the Scientific American:

In page 65 of the current volume of your esteemed paper, I find an article on the duplex telegraph instrument in England. You claim, in the article, this invention as an American one of some years standing. I take the liberty to bring to your notice the fact that Messrs. Siemens & Holske, telegraph engineers of Berlin, obtained in 1849 an English patent on the simultaneous telegraphing of a large number of despatches by means of combined wires. They improved that method in 1856 in such a manner that replies could also be sent, by which the method became practically important. The simultaneous telegraphing in one direction was not so much of a success.

In the summer of 1854, Professor Edland, of Stockholm, took up the same subject, and obtained the same result independently of Siemens and Holske, telegraphing (in August 1856) by his system between Stockholm and Upsala. In January, 1855, the line Stockholm—Gothenburg was worked on his system (see Poggendorf's "Annals of Chemistry and Physical Science," vol. xcviii, pp. 115 and 632).

I hope that you will accord a space in your paper to the vindication of the priority of a German invention.

Dresden, Germany. ERNEST SCHURMANN.

Fog Trumpet Signals.

To the Editor of the Scientific American:

My object in writing this is to present an idea for consideration in relation to the fog trumpet. It is a very useful instrument to the mariner in warning him of contiguity to land when other means fail; but though it has a voice (and a loud one) it has no speech, and this I propose to add.

Sounds of ascertained duration may be learned and be understood to represent the alphabet; our telegraph operators read by sound. You will at once see that I am indebted to that eminent man, Professor Morse, for this idea. Morse's alphabet, as everybody knows, is represented by dots and dashes. I propose to use figures instead of letters, the figure 1 for the dot and the figure 2 for the dash, and make the combination as follows, which can be altered to any extent: 1, 2, 11, 12, 21, 22, 111, 112, 121, 122, 211, 212, 221, 222, 1111, 1112, 1121, 1122, 1211, 1212, 1221, 1222, 2111, 2112, 2121, 2122. The last number in this series is —. —— and, if so arranged, will stand for z. The next thing is to apply to the trumpet a mechanical arrangement controlling the motive power that is used in the vibration of the trumpet's tongue. This will be no difficulty.

The object of this is to spell out the name of the locality for the information of vessels within hearing, Cape Race for example; the second word would be quite enough to let mariners know their position. There should also be power to use this valve by the keeper for the purpose of communicating with a ship at sea, and when this is done, the alphabet being known and a trumpet provided in every ship, communication between ship and shore and between ships at sea, in fog or in the night, would be greatly facilitated. I am inclined to believe that the steam whistle in steamers would answer the purpose, also that two telegraphic operators of experience could communicate intelligibly with each other at a distance by this means. I do not seek gain in this, but only to benefit humanity at large. E. BRACE.

St. John's, Newfoundland.

Uncontrollable Fires.

To the Editor of the Scientific American:

The article of P. H. Vander Weyde in the SCIENTIFIC AMERICAN of January 6, 1872, on the "Latent Heat of Dissociation," explains in part why great fires are so uncontrollable. It is there stated that, when steam is heated to 5072° Fah., it is decomposed into a mixture of oxygen and hydrogen gases, and about 8,000 units of heat are made latent; and when the gases again unite, which they will do when cooled by contact with colder substances down to a point below 5072°, the 8,000 units of heat will again become sensible, the process being analogous to that by which 962 units of heat are made latent when water is evaporated, the same amount of heat being again made sensible when the steam is condensed.

In great fires there is always a great quantity of water in the burning materials, and the heat is doubtless above 5072°. The result would be that the mixed gases would be driven out of the fire and would recombine as soon as sufficiently cooled, exposing any building or other object upon which they might strike to the heat of an oxyhydrogen flame.

Oshkosh, Wis. SAMUEL P. GARY.

Action of Glycerin on Strychnia.

To the Editor of the Scientific American:

I notice, on page 57 of your current volume, that P. Bert has found a remarkable property in carbolic acid, namely, that it will dissolve strychnia, and he recommends it as a test for that alkaloid. In last November, I had occasion to use strychnia with a solution of carbolic acid in its own weight of glycerin. I used one grain of strychnia in half an ounce of the solution. The mixture was clear; but after standing three or four days, the weather being cold, it looked creamy, and on the top there was a stratum of a reddish brown color of a quarter of an inch thick, which I attribute to "sulphoglyceric acid," as the alkaloid was a sulphate. By an examination with the microscope I find it to crystalize in long slender crystaline needles, somewhat like the barbs on a wheat ear, being tied together and branching out at an angle of about 80°.

I have not used carbolic acid as a test for strychnia, nor have I seen it so used, but I should be glad if this should awaken more research in regard to the feasibility of its being used for that purpose. CLARENCE OWEN.

Bloomington, Ill.

The Million Dollar Teleseope.

To the Editor of the Scientific American:

I fully concur in the idea advanced in the SCIENTIFIC AMERICAN, by F. H. R., with regard to the million dollar telescope, and you may count on me for at least three shares, and very likely, if I see it is to be a success, five shares. If times are hard, I will also be one of those to attend a meeting to help on this grand enterprise. If you see fit, make use of this in any way to agitate the subject. STOCK HOLDER.

CENTRAL AMERICAN VOLCANOES.—A correspondent in Salvador, in Central America, under date of December 8, writes to the *Panama Record* as follows:—The volcano, which is some leagues distant from the town of Santana, has dried up a lake which for 500 years or so existed at the base of the craters; but although vast quantities of steam are ejected, and the trees lining the inside of the crater are scorched up and withered, as also are those to a limited distance near the top on the outside, no ejection of lava has yet taken place. The volcano of Isaleo, which was active until quite recently, now shows no sign of life; and the supposition is that some strata which cut off the communication between the two volcanoes have burst through or fallen in, and so changed the channel of the fire.

A CORRESPONDENT, T. M., says: Cut your soiled paper collars into strips for tapers. They burn slowly and are not easily extinguished.

POST OFFICES were first established in France in 1464; in England in 1581; in Germany in 1641.

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THE STRENGTH OF TIMBER.

BY JOHN ANDERSON, C. E., LL. D., F. R. S. E.

The strength of a piece of timber depends upon the part of the tree from which it is taken. Up to a certain age, the heart of the tree is the best; after that period, it begins to fail gradually. The worst part of a tree is the sap wood, which is next the bark. It is softer than the other parts of the wood, and is liable to premature decay. The deleterious component of the sapwood is absorbed if the tree is allowed to grow for a longer period, and in time the old sapwood becomes proper timber fiber similar to heart wood. Hence, the goodness of a tree, for timber purposes, depends on the age at which the tree was cut down. When young, the heart wood is the best; at maturity, with the exception of the sap wood, the trunk is equally good throughout; and when the tree is allowed to grow too long, the heart wood is the first to show symptoms of weakness, and deteriorates gradually.

The best timber is secured by felling the tree at the age of maturity, which depends on its nature as well as on the soil and climate. The ash, beech, elm, and fir, are generally considered at their best when of 70 or 80 years' growth, and the oak is seldom at its best in less time than 100 years; but much depends on surrounding circumstances. As a rule, trees should not be cut before arriving at maturity, because there is then too much sap wood, and the durability of the timber is much inferior to that of trees felled after they have arrived at their full development.

The strength of many woods is doubled by the process of seasoning, hence it is very thriftless to use timber in a green state, as it is not only weak, but it is exposed to continual change of bulk,form, and stability. After timber is cut, and before it is properly seasoned, the outside is found to crack and to split more than the inside of the mass, because it is more exposed to the desiccating effect of the surrounding atmosphere; but, as the outside dries, the air gradually finds its way to the interior. If timber is cut by the saw when green, and allowed to season or dry in a gradual manner, it is found to be the most durable. In the arts, however, artificial drying is often resorted to, as in the case of gun stocks. These are put into a desiccating chamber, where a current of air at 90° or 100° is passed over them, at such a rate as to change the whole volume of air in the chamber every three minutes, and it is found that a year of seasoning may thus be saved. The walnut wood is as good, after this process, as if the seasoning had been accomplished by time and exposure, and works more smoothly under the cutting instruments of the stock machinery.

Wood will always warp after a fresh surface has been exposed, and will likewise change its form by the presence of any moisture, either from that contained in the atmosphere or from wetting the surface. The effect of moisture on dry wood is to cause the tubular fibers to swell; hence it is that, if a plank or board is wetted upon one side, the fibers there will be distended,and the plank, in consequence, must bend.

The amount of the shrinkage of timber in length, when seasoning, is so inconsiderable that it may in practice be disregarded. But the shrinkage in transverse directions is much greater, and presents some peculiarities which can only be explained by examining the structure of the wood, as resulting from its mode of growth.

Mahogany is a beautiful, close grained wood, but is used not so much on account of its strength, but more frequently because of its non-liability to shrink, warp, or twist, and from the peculiar property of taking a firm hold of glue. In the last respect it is superior to any other wood. Mahogany differs greatly in regard to its closeness, hardness, strength, and beauty. That from Honduras, called "bay wood," is much inferior to that called "Spanish" mahogany, which comes from the West Indies; the former is much used in the construction of light textile machinery, but chiefly on account of its cheapness; and the latter is used for furniture or for other ornamental purposes. As regards strength, this wood is inferior to oak in all respects, and its great characteristic defect is unsuitability for exposure to the weather or, indeed, for any purpose where it is made alternately wet and dry. When so subjected, it rapidly decays, and loses all its good qualities.

Oak, taken as a whole, is one of the strongest and most durable of woods, and is especially adapted for exposure to the weather of a damp climate, and is indeed suitable for almost every purpose where the properties of strength, stiffness, and toughness, combined with endurance, are required. Its value for shipbuilding is proverbial, and in its employment for the staves of casks,for treenails,for carriage wheels, and for all such purposes requiring lightness and strength in combination, it is equally useful. From time immemorial it was esteemed the best timber for heavy roofs, and the condition in which some of these grand old roofs have reached our era fully attests the wisdom of the selection.

Clacking and Over-Reaching in Horses.

Common as are these two faults, they are frequently misunderstood. An over-reach is looked upon as an unavoidable accident, and clacking is treated by irrational alterations of the hind feet shoes. We couple them together because they present some common features. Both consist of interference with the fore foot by the hind one, both are due to some temporary defect in the action, and both can be prevented by altering the form of shoe. Clacking or, as it is sometimes called "forging" is the name given to the sound produced by the hind shoe striking the fore one in progression. It is usually heard at the trot, and seldom noticed in adult horses. It is most common in young horses out of condition and especially noticeable when they are tired. The noise is produced by the hind shoe striking the under surface of the fore one just behind the toe, not at the heels. When the blow has been repeated so as to leave an impression, the marks are found on the inner edge of the fore shoe. This is important, as it shows us that the length of the shoe is not at fault, and it suggests the removal of the part where striking occurs. Removal of this edge is equivalent to making a shoe concave instead of flat on the ground surface, and such a shoe is found to effectually prevent a recurrence of the objectionable noise. The ordinary hunting shoe, especially the narrow one made in a "cress," is the best possible form. For harness horses, where more substance is required for wear, the ordinary shoe seated on the outside instead of the inside is usually sufficient. A case may be met with in which this alteration is not effective. We must then alter the hind shoes, making them square at the toe, with two clips—one on either side—and set back a little on the foot. The wall at the toe should not be rasped off, but allowed to protrude a little. Too often the hind shoes are the first to suffer alteration, sometimes of a very objectionable kind; for instance, we have seen the toe of a hind shoe made diamond shaped and prominent, so as to come in contact with the sole of the forefoot instead of the shoe. This is a most irrational and somewhat dangerous expedient. It leaves the offending part of the fore shoe untouched, and favors the infliction of injury to the foot. Even when the hind shoe is only made short and placed back on the foot, there is a risk of the horn at the toe being unduly worn, and there is a shortening of the leverage of the foot which must more or less affect the powers of progression.

If a horse "clacks," rest contented at first with altering the fore shoes as we have described; improve his condition, and ride him up to the bit, but not past his pace.

"Over-reaching" is an injury to the heel of the fore foot. It is sometimes merely a bruise, but more often a lacerated wound, a small round portion of skin being left hanging, nearly detached from the heel. The offending part of the hind shoe is its inner circumference or edge, so that the injury must be caused by the hind foot being in the heel, and the skin caught as the foot is retracted. The inner edge at the toe of a hind shoe becomes very sharp after a few days' wear, and will cut like a knife. As in "clacking," the indication for prevention is to remove the offending edge. This cannot be thoroughly done with the file, but when the shoe is hot, the edge behind the toe can be cut out with the "fuller" so as to leave the shoe concave. As over-reaching is an accident peculiar to the gallop, it is well always to shoe hunters so as to guard against the occurrence. The neatest and best hind shoe for a hunter is made, like the fore one, in a "cress," and presents a concave ground surface and rounded edges.

When a heel is injured, it is always well to try and save the piece of skin. It should not be cut off until it is certain that it will not reunite to the tissues beneath. One good fomenting on reaching the stable is enough; after that use the simplest water dressing, and under no circumstances use poultices, which only increase the chances of a slough and retard the healing process. Should healing seem slow, apply a mild stimulant, such as a piece of lint wet with a mixture of carbolic acid, one part, to glycerin, twenty parts.

The Decay of Wood.

Wood, being vegetable matter,is of course liable to decay; but how to turn it to the best account with this known attribute to contend with may be worth inquiry. The closer the grain and the heavier the wood, the less liability there is to decay; but for building purposes, as at present carried on, light and open grained woods must be used. We cannot, in these times of excessive competition, go back to the old oak timbered and floored houses of our ancestors. It would, however, pay landlords to build solid, substantial houses, and let them even at the present scale of rental. For instance,in digging away the foundations of the Savoy Palace, built upwards of six centuries ago the oak piles were found perfectly sound, as was the planking which covered the pile heads. But houses are built on a very different principle now, namely, to sell again, and perhaps again, before the permanent owner invests in them, and then a coat of paint and a judicious use of putty cover all imperfections.

The flooring boards, being kept in sheds, present quite a different appearance to the same quality of wood exposed on the quays. Putting on one side the question of expense, the practice of matting up the end of the piles, as practiced in the north of England, cannot be recommended. It certainly preserves the fresh appearance of the wood, and makes it appear as if just discharged from the ship; but it impedes the free circulation of air, and anything that does that is strictly to be avoided. Better by far have the wood shaken at the ends than sweating inside, with here and there places where the penknife blade sinks in with hardly any pressure.

The decay of wood arises from internal and not external moisture; hence the danger of shakes, as they admit it often to the very centre; and so long as free evaporation is allowed, decay will not very readily set in. It would be very absurd to say that no paint ought to be used in the interior of a house, but it is certain that a piece of wood painted on both sides will not last nearly so long as one not painted at all. The reason is evident. The paint effectually closes all the pores and prevents the evaporation of the moisture, which even the best seasoned plank will contain, and hence decay sooner sets in, in one shape or other. For the same reason wood painted on one side only will last longer than that painted on two sides. Thus in an old building, the wainscot, doors, windows, etc. will be found to be affected when the staircases will be sound, because never painted. The old houses in the quaint city of Chester prove the truth of this. Some years ago, a Liverpool builder who had some contracts there told the writer that the numerous exposed beams were generally sound, and they are all unpainted, but the inside work had apparently been renewed. The best that can be done, under all circumstances, is to give a coat of paint before leaving the workshop, and this is generally done, at least in the large establishments.—*Building News.*

Glacier Motion.

"In making some experiments on the freezing of water," says Mr. John Aitken, in *Nature*, "it was noticed that, after the same water had been melted and frozen a number of times, it generally burst the tube in which it was frozen." This phenomenon the author considers to be the germ of glacier motion, and he believes that the ice which has only been frozen once has more air in it than that which has been frozen and melted a number of times; as each succeeding freezing deprived the ice of a quantity of air or some other gases. The natural conclusion seems to be that ice with air in it is a viscous substance, adapting itself to the shape of a containing vessel, though pure ice does not.

In the detailed account of the experiments, we find that rods of snow ice, made in close imitation to the material composing glaciers, bent much more easily, when supported at the ends and acted upon by a weight suspended at the middle, than others made from ice from pure water. Small rods of snow ice, 2 inches in diameter, could be greatly distorted, but when it was attempted to bend them around a small cylinder, by the time the circle was half turned they broke, even under a pressure which they easily bore in the beginning. It was found that the bending of the ice had developed a lamellar structure in it, similar to that found in glaciers,which rendered the beams weaker on account of the cohesion of their particles along, the planes of lamination, rendered less. Hence, further experiment proved that, if a small portion of the circle was bent at a time and the pressure then removed, the particles evidently rearranged themselves; and by continuing the process, a ring of ice was produced from a perfectly straight beam. It is believed that these conditions of alternate rest and pressure, are, in all probability, those which exist in glaciers. After pressure has acted on one part of the glacier, bending takes place, so relieving the ice at that part from the pressure, which comes to bear on another portion of the glacier; and before the pressure again comes to bear on the first part, its strength and viscosity have been resolved by rest.

There are other causes which may assist in producing glacier motion; these are briefly enumerated by the author as follows: The sliding of the ice over its channel, this being assisted by melting of the ice where its rests on its bed; the melting point of the ice, in contact with obstacles, being lowered by the pressure of the mass behind; the melting in the body of the glacier, part of the water finding its way to the channel under the ice and part being refrozen; the crevasses in the glacier (due to the fracture of the ice) enabling large masses to move into different positions more easily, than if the ice were solid; and lastly, the old dilatation theory, which accounts for some of the pressure which causes motion.

Improved Paper Bag Machine.

The paper bag machine invented by Miss M. E. Towne, of Holyoke, Mass., and recently manufactured for the inventor by the Ames Company, is deserving of a more minute description than it has heretofore received. It is a handsomely ornamented structure about 10 feet long and 3½ feet high. The paper enters the machine from a roll, and is at first placed around a form, which can be adjusted so that a bag can be made of any width desired. The paper is worked along by a feeder, and the first process is to paste the bag lengthwise, which is done by a thin wheel rolling upon it, the wheel passing through paste in a dish slightly elevated from the machine. The paper then passes under a knife worked up and down by what is termed a continuous motion and stop motion, and a tucker catches the paper, holding it in position while it is being cut off. There are two small folders which work from each side of the machine, folding the bottom of the bag in the required form, and side arms to bring the paste to the center and paste the bottom of the bag. The bag then passes through a revolving press, which securely fastens the parts already pasted. The last tucker has an up and down motion, and places the last fold on the bottom of the bag, which is pasted by two more side pasters. The bag then passes through two more revolving wheels and is dropped completed.

Asbestos.

There are very extensive deposits of this important mineral within the limits of the United States, that found on the eastern slope of the Green Mountains and of the Adirondacks being of the best quality for fineness and tensile strength. The fiber of New York and Vermont asbestos varies in length from two to forty inches and resembles unbleached flax, when found near the surface, but when taken at a greater depth, it is pure white, and very strong and flexible. It is found also, in considerable quantities in the Tyrol, in Hungary, Corsica, and Wales.

MERCURIAL ointment is said to be one of the best materials known for preventing rust on gun barrels. It should be rubbed in thoroughly, both outside and inside, and well dried off, so as to leave but little on the surface. The quicksilver forms a thin film which protects the metal from moisture. The article may be obtained at any drug store.

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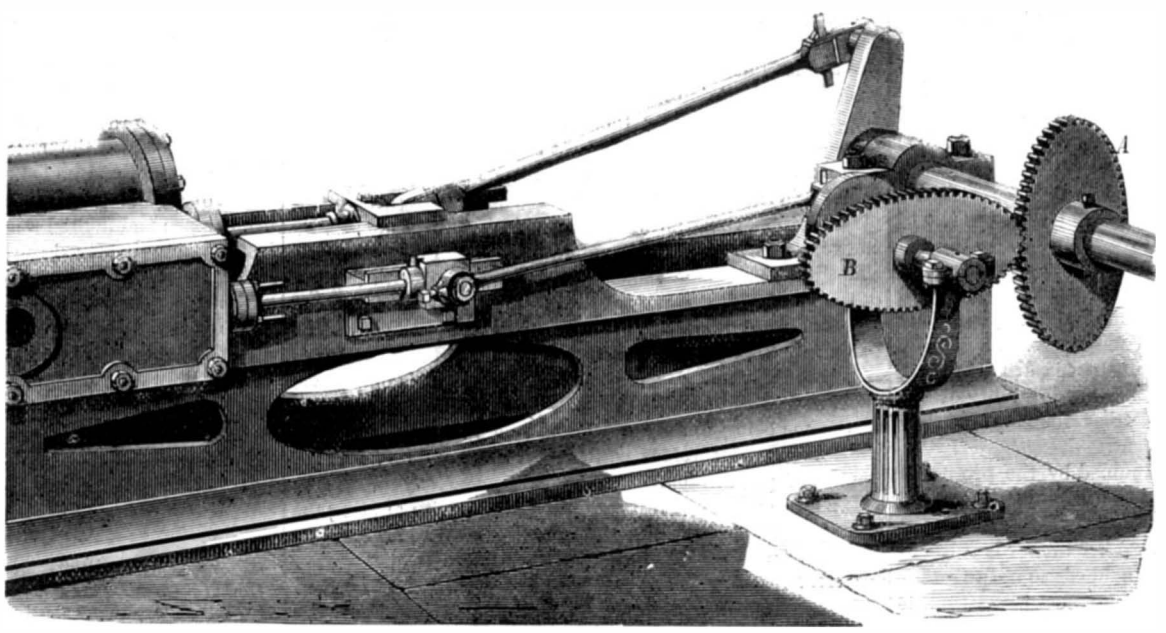
NEW VALVE GEARING FOR STEAM ENGINES.

The invention herewith illustrated is designed as an improvement upon the mechanism generally employed in connection with the common or single slide valve in steam engines. It is proposed to so move the single valve by retarding and increasing its motion that the steam can be cut off at any point of stroke desired, and yet keep the port open at the exhaust end until the stroke of the piston is nearly completed. At this moment, the motion of the valve is quickened, throwing the other exhaust port wide open, almost instantly relieving the engine of exhaust steam. It is claimed that, by this means, a wider average port is obtained in a given time, or while the piston is moving a given distance, and that the cutting off is effected with a quicker motion than can be obtained by two eccentrics.



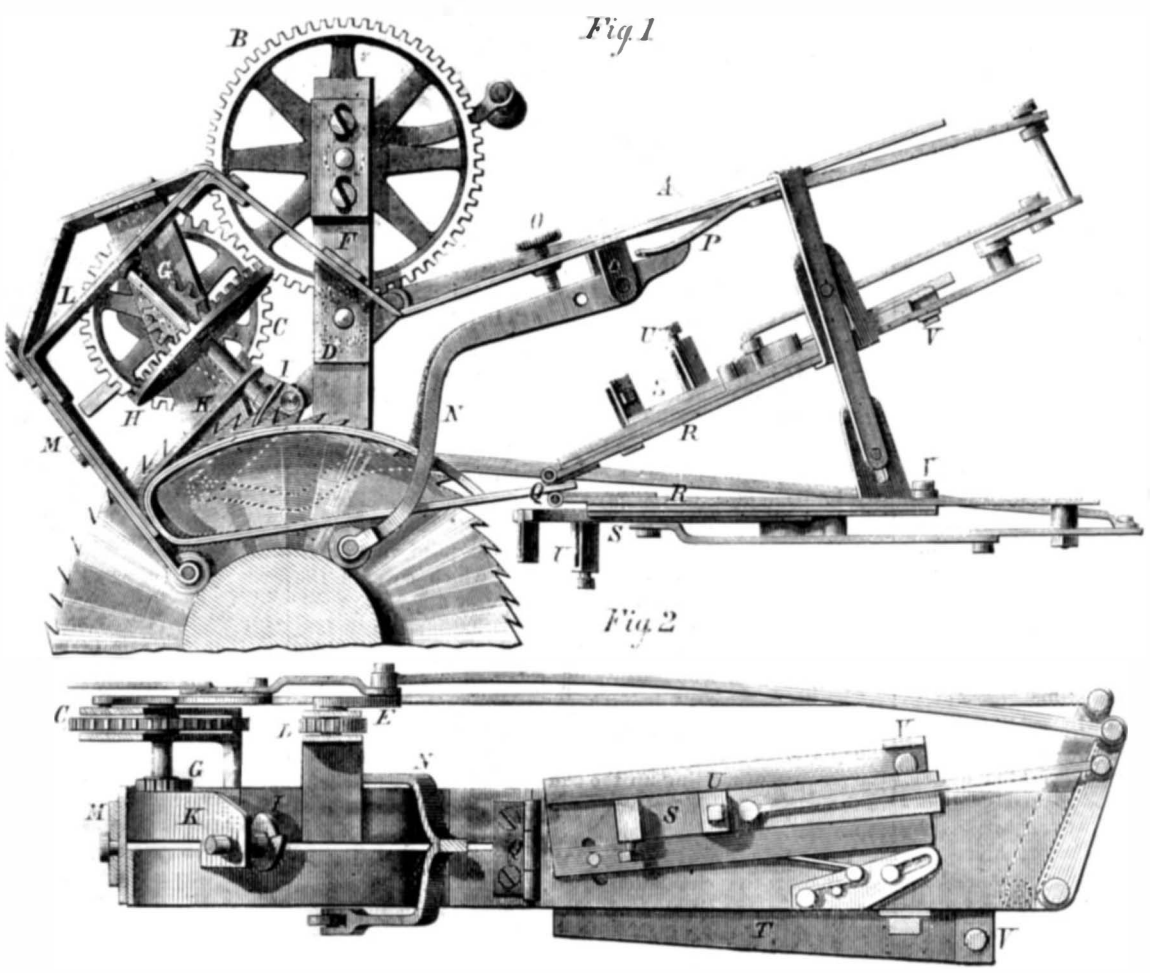
BACON'S NEW VALVE GEARING FOR STEAM ENGINES.

The desired object is, in this case, accomplished by means of the elliptical toothed gearing, A B, in our illustration, the wheel, B, being connected as shown with the valve. It will be observed that the varied motion is obtained as each toothed gear alternates from a large wheel to a pinion, twice in each revolution of the engine. By lengthening or shortening the crank on the small shaft, the valve is practically shortened or lengthened, and thus adapted to cut off at the desired point. The excessive compression or too early exhaust of steam when used expansively (due to the relative stationary position of the eccentric to the engine crank) is here claimed to be avoided, and the necessity of a cut off at the back of the valve (moved by an additional eccentric, thereby involving a loss of power) is also obviated. This gear can be fitted to any engine of the slide valve pattern in use.

Patented October 15, 1872. Further information may be obtained by addressing the inventor, Mr. William S. Bacon, Sulphur Springs, Crawford county, Ohio.

GIN SAW FILING MACHINE.

We illustrate herewith a recently invented gin saw filing machine which, it is claimed, will fit and work well upon any form of cotton gin. A is the frame of the machine, and B the driving wheel, to which the hand crank is applied. C is a wheel acted upon by B, and D is a pinion under the latter. E is a crank on the axle of said pinion. F is the upright, with its brace attached to the upper and lower part of the frame, A. G is a small pinion which works in the horizontal cog wheel, H, on the upright shaft, which is placed at an angle of forty-five degrees, so that the feed wheel, I, may stand precisely with the pitch of the teeth. This shaft is held between the parts, K and D. The feed wheel, I, has a slit in the edge, the under lip of which is turned down so as to catch the next tooth at every revolution, thereby acting as feeder to the files. By suitably proportioning the above described parts, the files are arranged to have six strokes to each revolution of the driving wheel, B, and feed wheel, I.



ASBILL'S GIN SAW FILING MACHINE.

At the front of the machine is placed a sliding rest, M, the two small wheels at the lower end of which rest on the wooden cylinder of the saws when the apparatus is at work. N is a similarly arranged rear rest. On these parts, the whole weight of the machine is borne when it is adjusted to the saw. The front rest, M, is lowered or elevated by two screws in the slots. The rear rest, N, is depressed by the screw, O, and elevated by the spring, P. Q Q are the hinges, and R R movable plates attached thereto. S S are the file plates, T T movable or sliding spring plates, and U U file holders; V V are slides which serve to move the rear end of the file plates in or out from the center, thus giving the files a deeper or shallower cut on the teeth. The files are of the ordinary description used in handsaws, and are inserted in the file holders with the side screw against them and the top screw brought down upon their shanks, thus firmly securing them in their places.

In operation, the machine is set so as to allow the saw to come between the two halves of the frame and rest between the front wheels until the feed wheel, I, engages in the teeth. The front and rear rests are then regulated to take the whole weight, and so that the feed wheel has the precise range of the teeth. The movable plates are next adjusted until the files also have the range of the teeth, when they are firmly secured. The machine being steadied with the left hand, the crank of the driving wheel, B, is rapidly turned with the right hand, when the filing will proceed with great rapidity. The under file works upon the right side of the teeth and travels about ten teeth in advance of the top file, which operates on the left side. The operator stands with the points of the teeth toward him. The inventor claims that this device performs the work with neatness, uniformity, and lightning speed. He says that by its use a fifty saw gin can be filed within three hours.

Patented through the Scientific American Patent Agency, December 31, 1872. For further particulars address the inventor, Mr. Lewis M. Asbill, Charlotte, Columbia, and Augusta Railroad, Ridge Spring, S. C.

Red Cedar Hedges.

A correspondent, J. E. R., says that there is no timber for hedges comparable to the red cedar. It will do well in any soil with a little care at first. It is long lived, and grows very rapidly. To propagate it, gather the seed when ripe and prepare the ground as for drilling garden seeds. Plant the seed three quarters of an inch deep, slightly manuring the soil to force the growth at the start. The seed is abundant in Maryland, and our correspondent believes it will be valuable in many States where hedge trees are becoming scarce.

Sea Water for Extinguishing Fires, etc.

A correspondent, J. P., suggests that, in cities on the seaboard, large rafts might be arranged to rise by the power of the tides, and, in falling, be used to run light machinery and to force up sea water for washing streets and putting out fires. And in any inland city, where there is a flow of water, an iron tube might be arranged to catch the stream and turn it into an upright tube. The water would be driven upward by its own momentum, and a head would thus be created, varying in hight as the velocity of the stream, which could be used at discretion.

Observations on the Duration and Multiple Character of Lightning Flashes.

Arago has classified the different forms of lightning under three heads: 1st, linear zig-zag flashes; 2d, flashes appearing as a broadly diffused light (sheet lightning, heat lightning), and, lastly, the rarely occurring discharges which are seen as slowly moving balls of fire. The first form is due to the production in the atmosphere of a gigantic electric spark, and the majority of physicists and meteorologists suppose that flashes of the second form are due to the same cause, their light being seen either by transmission through or reflection from the clouds.

Professor O. N. Rood, of Columbia College, communicates to the *Journal of Science and Arts* an interesting paper detailing observations made by him on the nature of lightning flashes. The apparatus used was a small train of toothed wheels, driven by a spring so that it should be capable of rotating a circular pasteboard disk which was provided with four open sectors. On examining lightning flashes of the second form with this rotation apparatus, it was found that each flash consisted of a considerable number of isolated and apparently instantaneous electric discharges, the interval between the components being so small that they constituted a continuous act.

From the observations made, Professor Rood concludes that the nature of the lightning discharge is more complicated than has been supposed; it is usually, if not always, multiple in character, and the duration of the isolated constituents varies very much, ranging from intervals of time shorter than one sixteen-hundredth of a second up to others at least as great as one twentieth of a second; and, furthermore, a variety of the latter kind may sometimes be found in the components of a single flash.

In the examination of the spectrum of lightning by Dr. Vogel, a number of lines were identified as also occurring in the spectrum of the electric spark in the ordinary atmosphere, but what is remarkable; it was found that sometimes the spectra consisted of bright lines on a dark ground, while at others bright lines were traced on a less bright continuous spectrum, and, finally, sometimes a continuous spectrum destitute of lines was obtained. The discharges were principally of sheet lightning. Professor Rood considers that the continuous spectra destitute of lines were due to the prolonged constituents above referred to; and the occurrence of bright lines on a less bright ground, he refers to cases where instantaneous and prolonged constituents were noticed by himself, the normal spectrum of bright lines on a dark ground being produced by flashes more nearly instantaneous. It is also believed that zig-zag, heat, and sheet lightning are really identical, being in point of fact due to the same cause, but viewed under different conditions.

For the study of lightning flashes, the author recommends a black or gray opaque disk about 3·9 inches in diameter, with one open sector. The best form for the shortest and longest durations is that of a square, with sides of from 0·27 to 0·39 inch; for examining the multiple character of flashes, simply a long narrow sector of 1° or 2° is preferable. A spring rotation apparatus may be used, so as to admit of rotations up to 20 or 30 per second.

ACID in white lead may be detected by putting a small portion of the lead in a cup, pouring a little warm water over it, and stirring the lead in the water. Then add a few drops of a solution of iodide of potassium; and if the lead is acid, or contains acetate of lead, the water will turn yellow.

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THE COFFEE GARDENS OF ARABIA.

Coffee is still cultivated in "Araby the blest," the coffee gardens there being on terraces which reach an elevation of about 3,000 feet. The soil is kept moist by means of smal artificial canals, which are made to irrigate the whole by the water falling from the upper to the lower terraces. The trees here are planted so close together that the thick foliage shelters their roots from the tropical heat of the sun.

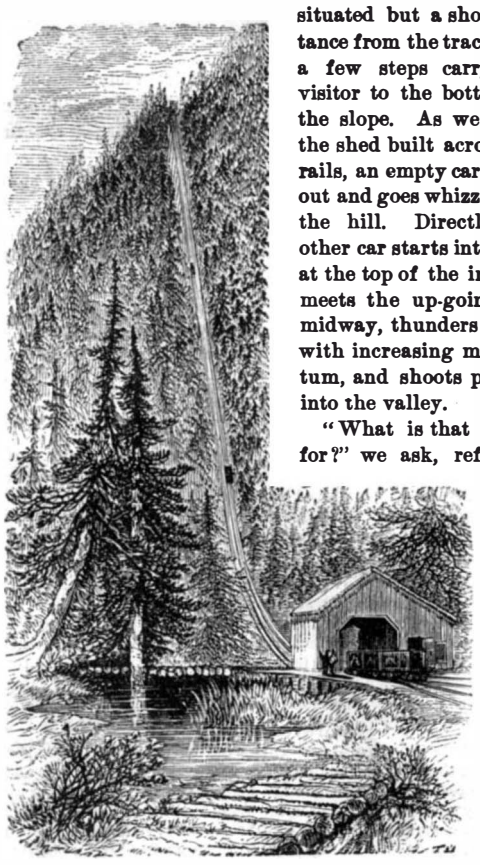
Our engraving represents the famous coffee hills of Yemen, in Arabia, where Niebuhr states the berry was first cultivated after it was brought from Abyssinia by the Arabs, and where the ripened fruit, it is said, has a flavor and fragrance which it is impossible to transplant. For ages before its use among the western nations, coffee was raised on these hills. The fruit begins to ripen in February; and when the seeds are prepared, they are conveyed to the city of Beit al Fakih, where part goes to Mocha and the rest to European markets.

THE COFFEE GARDENS OF ARABIA.

It has been computed that the annual consumption of coffee is 1,000,000,000 pounds: and that, with the exception of bread, sugar, and tea, there is no product of more general consumption than this invaluable bean. When we consider how universally coffee is used as an article of diet throughout Turkey, Egypt, Arabia, Persia, and parts of India, besides the more moderate but equally general consumption in Europe and America, we shall find it difficult to overrate its importance, as vast multitudes of persons are engaged in its cultivation, transportation, and preparation for use in many quarters of the globe.

THE RALSTON INCLINED RAILWAY.

At the head of the Lycoming Creek valley, near Ralston, in Pennsylvania, is the inclined railway to the McIntyre coal mines, which serves to carry the coal from the pits to the railroad at the foot of the mountain. The lower terminus is situated but a short distance from the track, and a few steps carry the visitor to the bottom of the slope. As we enter the shed built across the rails, an empty car starts out and goes whizzing up the hill. Directly another car starts into view at the top of the incline, meets the up-going car midway, thunders down with increasing momentum, and shoots past us into the valley.



"What is that cavity for?" we ask, referring to a depression under the track inside the shed. The starter informs us that it is where the bumper goes in to let the car pass on, and just then, an empty car being hauled up from the siding, he pulls a signal wire communicating with the other end of the road. The stout wire cable in the middle of the track begins to move, and a heavy wedge-shaped mass of timber comes up from the cavity, broad end first, strikes the car with a shock that sends it some feet up the slope, and stops it on its return. It saves the trouble of hooking and unhooking the cable, we are told, and is much safer. When it arrives at the bottom of the slope, a spring changes the gage of the wheels; it then runs along a narrow track into the hole, and the car passes over.

At the invitation of the starter, we enter the empty car. The signal is given, and before our equilibrium is recovered from the jerk that nearly upsets us, we are rushing up the slope. The cable sliding over the rollers produces a whirring sound that makes our fierce motion seem all the fiercer, while the steepness of the descent and the absence of visible motive power combine to lighten the effect of the ride. The mountain seems to grow beneath and above us, as the valley expands and deepens below. We stop on the verge to look down a thousand feet beneath; and then, jumping into a loaded car which comes swiftly by, we begin the descent. The speed is great, but there is no fear-inspiring rush, no blur of objects hurtling past. We look out into the valley; it rises slowly as we descend, and that is all. Not until we shoot through the shed and out upon the level, do we realize that our motion has been particularly rapid or peculiar.

THE BRIDAL VEIL, HAVANA GLEN, N. Y.

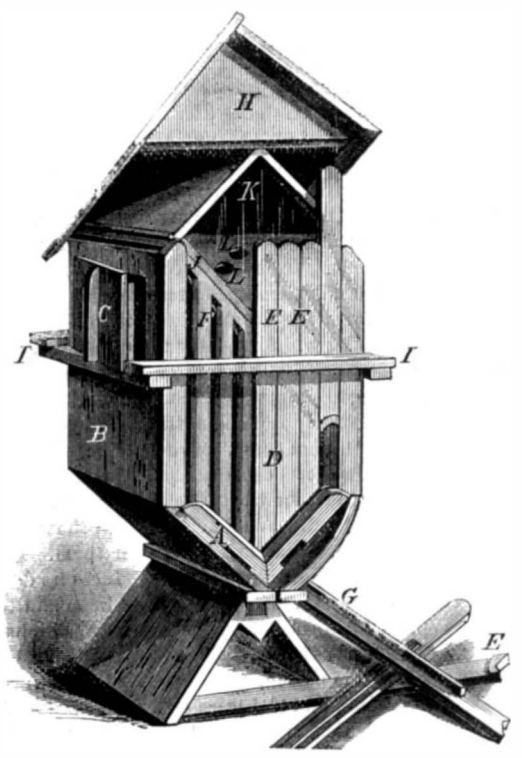
There are no portions of the country which offer greater attraction to the lover of the beautiful and the picturesque than the so called "glens," situate near the towns of Watkins and Havana, at the head of Seneca Lake, in New York State. These natural formations are cañons eroded from the rock by the action of water, and form a succession of ravines and gorges which, from their great extent, produce scenes of remarkable variety and grandeur. At times the bare cliffs give place to thickly wooded escarpments; vegetation creeps down into the gorge and throws a network of beauty and grace, festooning the sides of precipitous rock.

Our engraving represents one of the most interesting spots in the Havana glen, from a point where the strange geological formation is best apparent. The rock is moderately shaly, and has a strongly marked system of rectangular joints, dividing the cliffs into square towers and buttresses. When a portion of the precipice falls, it does not leave a jagged face but a mural surface, as smooth and even as a well built wall, giving the sides of the cañon an appearance of grand simplicity. The eroding current follows the lines of division, zigzagging at right angles rather than curving after the fashion of ordinary streams.

It seems hardly credible that such a vast gorge as that represented could be cut by the slender stream which showers a mist of spray, like the film of a bridal veil, over its cliffs. But there is no sign of fissure at the bottom of the glen, and a deep pond is there, which must, at some time, have been beneath high falls, the constant action of which hewed for it a basin in the rock. This pool begins at the foreground of our engraving, from which an idea may be obtained of the great ravine which the constant abrasion of the cascade—continuing perhaps for ages—has gradually worn away. The record of its work is but faint, for the frost has destroyed the water marks by breaking up the shale; and although the solid rock above would retain the imprint, the fragments at the bottom of the gorge show that it eventually becomes undermined and, toppling over, buries the marks out of sight.

THE HIXSON BEEHIVE.

Our engraving represents a new form of hive which, it is claimed, combines improved arrangements for permitting the examination of the bees and comb frames, and also for utilizing the animal heat of the insects for warming the honey and boxes. The construction is such that the objectionable space between the frames and sides of the hive,



which in winter affords passage for currents of cold air and in summer becomes choked with wax, is avoided.

The parts of the floor, A, are at right angles, and incline upon and from the center. In the removable sides, B, are openings, one of which is shown closed by the door, C. The side, D, and that facing it are composed of narrow vertical boards, E, all of which, with the exception of the middle one, are detachable. Each board is as wide as the distance from center to center of the comb frames, F, and is provided with a rib, G, on the inside, to fit into the space between said frames. By this means, a side is obtained which, while sufficiently light, is readily removable, piece by piece, when it is desired to inspect the interior of the hive. The sides are held together by the cap, H, and bars, I; and the boards, E, are further secured by metal plates arranged in their upper extremities, not shown in the illustration. The comb frames, F, conform in shape to the angle of the floor, slightly above which they are supported by stud pins. By similar means they are separated from each other, the interstices thus formed giving access to the bees. J is the honey board, receiving the square honey box, K, within the space occupied by the bees, so that it will be warmed in cold weather

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by their natural heat. Entrance to the latter is afforded through the holes, L.

It is claimed that all the advantages of movable comb hives are here combined without the attendant defects. Ready access to the combs, when it is necessary to pry them straight, is gained by removing one or more of the detachable boards, an operation which, it is clear, will not disturb the bees as much as if the whole side were, as is usually the case, displaced. There are eight separate comb frames, each one of which, with its comb and bees, may be lifted out and transported to another hive without exposing the insects in adjoining portions except at the place of division. The inventor further states that the hive can be opened and closed without killing a single bee or causing a drop of honey to run, and that it has been proved excellently adapted for purposes of artificial swarming, dividing, equalizing, and other apicultural operations.

Patented through the Scientific American Patent Agency, September 24, 1872. For further information address Messrs. Hixson & Co., Gallipolis, Ohio.

New Relation between Heat and Electricity.

Mr. Frederick Guthrie, in the *Chemical News*, states that it is found that the reaction between an electrified body and a neighboring neutral one, whereby the electricity in the neutral body is inductively decomposed and attraction produced, undergoes a modification when the neutral body is considerably heated. Under many circumstances, the electrified body is rapidly and completely discharged, a fact proved to depend upon the temperature of the discharging body and its distance from the electrified one and the nature (+or —) of the latter's electricity. The discharging power of a hot body diminishes with its distance and increases with its temperature. It also depends on the quality and not the quantity of heat radiated from it to the electrified body. It is necessary for the discharge that heat of intensity pass to the electrified body from a neutral body within inductive range.

It is shown that various flames, both earth-connected and isolated, have an exceedingly great power of discharging both kinds of electricity. As hot iron shows a preferential power of discharging — over + electricity, so it is found that white hot but isolated iron refuses to be charged with either + or — electricity. As the iron cools, it acquires first the power of receiving — and afterwards of receiving +. While white hot iron, in contact with an electrified body, prevents that body from retaining a charge of either kind of electricity, as it cools, it permits a + charge to be received and subsequently a — one.

A suggestion is made as to the existence of an artificial coercitive force, the presence of which, together with its diminution by heat, would explain much of the above.

Alcohol, Whiskey, Brandy, Wine and Ale.

Dr. Willard Parker, of this city, one of our oldest and most prominent physicians, in a recent address made the following statement concerning the effects of alcohol upon the human system:

For many years I was connected with the care of inebriates and paid particular attention to the character of those in my charge, and I have arrived at the conclusion that drunkenness is a disease. A man so affected cannot control his appetite, and must have drink regularly, and will have it at all hazards. A healthy man can refrain from drinking, but a diseased man cannot; and these men so addicted readily admit that. Men suffering from the disease have been cured and they will with tears in their eyes promise to abstain, yet on passing a liquor store they cannot help themselves, and will go in and have their whiskey. Now the question arises: What can be done? How shall we go to work? Society has been all the time trying to show what the use of alcohol makes us do, and many will reply it makes them feel good, and some will say it makes them crazy, drives them to desperation and to fight. Now let us drop that mode, and ask what does alcohol do to me, and not what it makes me do. That is the great starting point. We have to teach the people what alcohol does to them, and how it acts on them. It is as poisonous as arsenic or belladonna, and produces its deadly effect on those who use it; but then it is used in an adulterated state. Whiskey is a poison, but some believe and have the idea if we can get pure spirits that it is all right, but that is a mistake. Alcohol is poison, and the purer it is the more deadly is it in its effect, and if I were going to partake of it I would prefer that which is adulterated. With regard to ales and beer, it is believed that they are harmless, but with the presence of alcohol there is always danger. Those who partake of it become drowsy, and those who drink wines become stupid. In lager beer there is 3 or 4 per cent of alcohol, in ale 7 or 8 per cent; wine contains 23, gin 51 per cent, and brandy 53 per cent of alcohol. Even in cider there is 2 or 3 per cent of the poison present.

Ignition by Superheated Steam.

A correspondent, J. H., Jr., says that an engineer asserts positively that ignition can take place from steam pipes. He spoke of three instances where he knew it to be a fact. Shavings were set on fire, so that they blazed, at three different times. I told him I thought there must have been oil or other combustible matter mixed with them. He said there was nothing of the kind, nothing but dry pine shavings. The shavings were piled up against the pipes.

Professor E. S. Breidenbaugh, of Yale College, shows, by recent analysis, the very exhausting nature of tobacco crops in respect to soils. It appears that for every 1,000 pounds of tobacco grown, 102 pounds of the most valuable ash constituents of the soil are carried away.

Biogenesis.

Dr. William Roberts states that the results of over 300 experiments performed by him support the conclusion that the fungi, monads and acteria, which make their appearance in boiled organic mixtures, are not due to spontaneous evolution, but arise exclusively under the influence of pre-existing germs or ferments introduced from without. This method of experimenting consisted in ex posing organic solutions and mixtures to a boiling heat in glass flasks, the necks of which had been previously plugged with cotton wool. The fluid or mixture in the flask may be exposed afterwards to the full influence of light, warmth, and air; and yet it remains perfectly barren. As evaporation takes place, no organic growth makes its appearance for even years; but if the plug of cotton wool be withdrawn for a few minutes or a single drop of any natural water, however pure or well filtered, be introduced, then all is changed. In a few days the clear solution becomes turbid with bacteria and monads, or a mass of mildew covers its surface and soon half fills the flask.

A plug of cotton wool acts as an absolutely impervious filter to the solid particles of the atmosphere, while it permits a free passage to the gaseous constituents. It is considered impossible to doubt that the biogenic power of the atmosphere resides in its dust, and not in its gaseous ingredients; but as to whether it be a specific germ or ferment, or what its nature is, no sufficient evidence has yet been adduced.

Death of Professor Torrey.

John Torrey, a most eminent botanist, died on March 10, at Columbia College, of which institution he had long held the botanical professorship. His first contribution to science was a catalogue of the plants growing within 30 miles of New York city; this was published in 1817, and was followed by the "Flora of the Northern United States" in 1824.

His learning was extensive and varied. In 1824 he was Professor of Chemistry at West Point, and he afterward held a similar appointment at the College of Physicians and Surgeons in this city. He was also chief of the Assay Office in the United States Sub Treasury. He was stricken by pneumonia at the age of 80 years. Columbia College is largely his debtor for his eminent services as a teacher, and for his fostering care of her interests.

Death of Professor Sedgwick.

The eminent veteran geologist, Adam Sedgwick, died on January 27, at Trinity College, Cambridge, England, at the age of 87 years. His contributions to the literature of his favorite science were exceedingly numerous and valuable, and make up a large amount of work even for a career so lengthened. He was elected to a fellowship of his college in 1810, and had won for himself a name in science while the youth Roderick Murchison was fighting battles in Spain. His services to the world of knowledge are everywhere known and valued. By his care and, to a great degree, through his generosity the collections of rocks and fossils under his charge at Cambridge have become the most complete of any now open to the student.

Extinguishing Fires by Vapors.

In our description of the Babcock self acting tank, published on page 143 of the current volume, it is pointed out that "the gas seems to interpose a wall of non-conducting vapor between the hoseman and the fire, which protects him from the heat." A correspondent, W. M., refers to Professor Tyndall's work, "Heat Considered as a Mode of Motion," in which the fact is stated that the arresting power of carbonic oxide to heat rays compares with the similar resistance of the air to such rays as 750 to 1; and carbonic acid compares to air as 752 to 1. The apparent wall of vapor is, therefore, a scientific fact.

A BILL was recently passed in Congress authorizing the President to cause such experiments to be made and such information to be collected as in his opinion may be useful and important to guard against the bursting of steam boilers, and requesting him to communicate the same to Congress. The sum of $100,000 is appropriated for the purposes of the act.

DR. D. T. SHUMWAY, in a recent paper read before the Massachusetts Dental Society, advocates the use of ivory points, instead of steel, in packing gold fillings. The advantages claimed for the use of the ivory are that the gold will have better cohesion, its softness is preserved, it better adapts itself to its position, and the filling wears better.

A COUPLE of immense wire ropes, each between three and four miles long, have just been completed by Messrs. J. and E. Wright, of the Universe Works, Birmingham, Eng. One of these ropes, intended for the Wapping tunnel of the London and Northwestern Railway, at Liverpool, is six thousand yards in length, 5½ inches in circumference, and is composed of six strands having ten wires in each. The wire is wound round a hempen core. The weight of the rope is 34 tuns. The second rope is for the Cowlan's tunnel, at Glasgow, is five thousand yards long, and weighs 25 tuns.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From February 18 to February 19, 1873, inclusive.

FINISHING TOOL.—H. E. Forrest, Boston, Mass.
GOVERNOR.—R. W. Gardner, Quincy, Ill.
JOURNAL BOX.—J. A. Montgomery, Millburn, N. J.
LOOM.—S. T. Thomas, Gilford, N. H.
PRINTING PRESS.—H. S. Bingham, Philadelphia, Pa., *et al.*
SEWING MACHINE.—D. McC. Smyth, Orange, N. J.

DECISIONS OF THE COURTS.

United States Circuit Court---Southern District of New York.

TRADE MARK—J. L. SMITH *et al. vs.* REYNOLDS AND JACOBS.

[In Equity.—Before Judge Blatchford.—Decision July 27, 1872.]

The plaintiffs as owners of a trade mark for paints, consisting of the representation of a crown to be stamped or branded upon their goods, to wit: upon paint packages of all kinds, brought suit against the defendants, who also used the crown upon their packages. The court held the following points:

Causing the name of the firm which claims a trade mark and its place of business, to be recorded in the Patent Office is sufficient compliance with the first requirement of section 77 of the act of 1870, without specifying the names of those who compose the firm.

To designate "paints" as the goods for which a trade mark is to be appropriated is sufficient, without a more particular description.

The figure of a crown used as a trade mark for paints may indicate to buyers and dealers, by association, the origin and ownership of the same, and is of itself a lawful trade mark.

The case of R. W. English, Com'rs Dec. 1870, p. 142, and that of the Dutcher Temple Company, *ibid*, 1871, p. 248, cited and approved.

Registering a figure as a trade mark for paints in general, without any restriction as to the kind, gives no title to it if the figure has been previously used, in connection with words or other figures, as a trade mark for any particular kind of paint.

A trade mark must stand or fall as a whole, and the registry of one cannot be sustained, like a patent, for a part of it, though void as to the rest.

It was shown on behalf of the defendents that the use of the crown on paint packages was not original with the plaintiffs, and the Court therefore denied the motion for injunction.

J. Hough, for complainants.
F. Blount, for defendants.

Recent American and Foreign Patents.

Improved Fire Kindler.

Montraville Gernsey, Middleburgh, N. Y.—In preparing this kindling, any desired quantity of ordinary charcoal is immersed for thirty minutes, more or less, in a saturated solution of chlorate of potash and nitrate of potassa, dissolved in water. The charcoal is then dried and then immersed in a saturated solution of resin in ordinary petroleum oil. This solution is prepared by heating the petroleum to a temperature of from 180° to 200° Fahrenheit, and putting into it resin until no more will be dissolved. The charcoal is then dried in any convenient manner until the petroleum is evaporated. The petroleum dissolves or cuts the resin and carries it into the pores of the charcoal, where it is left when the petroleum evaporates. The resin is readily set on fire by a match or piece of lighted paper, and the heat thus produced decomposes the chlorate and nitrate, and sets free large quantities of oxygen to support combustion, thus producing an intense heat, kindling the coal or wood fuel quickly and effectually.

Improved Window Shade.

Edward E. Johnson, Painesville, Ohio.—This invention has for its object to improve the construction of window shades, inside blinds, etc., which improved blinds shall be so constructed that any desired part of the window may be uncovered to admit the light. The invention consists in sections formed in the body of the main blind or shade in such a way that the said sections may be rolled up from their lower ends, or the blind and sections may be rolled up together.

Improved Millstone Balance.

George W. Wilson, Chebanse, Ill.—The importance of having the running stone of a grinding mill perfectly balanced is well understood. In this invention it is accomplished by means of a metallic riveted band and a series of adjustable grooved or ribbed metallic weights. The band is made by riveting together the ends of a piece of band metal. It is made larger in diameter than the stone, so that the weights may be inserted. The band is tightened around the stone by the weights. The latter are somewhat tapering in form, and are made circular on their outer and inner sides, so as to conform somewhat to the circle of the stone and the band. The outer or convex sides of the weights are grooved or ribbed, which prevents them from working out of their places. They may be placed in any part of the band, as may be required to balance the stone.

Improved Scissors.

John A. Correa, Green Bay, Wis.—The object of this invention is to provide means for securing the blades of scissors or shears together, so that they may be adjusted at pleasure to work tightly or loosely without the use of a screw or nut; and it consists in one or more cam wheels working in combination with the fulcrum pin. When the wheel is turned, an inclined plane bears against the upper edge of a slot and draws the pin upward and the blades together.

Improved Land Marker.

John Cuff, Emery, Ohio.—This invention has for its object to furnish an improved machine for marking the ground in cross-row for planting corn, by crossing the field in only one direction. The axle is made of such a length that the wheels may be at the distance apart required for the rows, so that the tracks of the wheels may mark the places for the rows in one direction. The wheels are rigidly attached to the axle so that they will revolve exactly together at a distance apart equal to the desired distance apart of the hills of corn. The cross blocks upon the two wheels are exactly in line with each other, so that the corresponding blocks of the two wheels may strike the ground at the same time and thus mark the cross rows. Arms are made of such a length that, when swung down into, or nearly into, a vertical position, the wheels will be raised from the ground, so that the machine can be conveniently turned or moved from place to place. By this construction, by moving a lever forward the wheels will be allowed to come in contact with the ground, and by moving the said lever rearward the wheels will be raised from the ground.

Improved Scraping Instrument.

Van Ness Davis, Stoneham, Mass., assignor to himself and Frank A. Davis, of same place.—The object of this invention is to furnish a tool or implement for scraping kitchen utensils, and cleaning deposits of burned gravy or other sedimentary deposits from the corners or angles, and also to be used in house cleaning; and it consists in a simple flat blade with the scraping edge at the end, and with a shank and handle.

Improved Tool Holder.

Levi L. Lamb, Chelsea, Mass.—This invention consists of a box handle for containing the tools and holding them for use, comprising a box and cover, which are pivoted together near the end for holding the tools for use, so as to open by swinging the cover in the plane of the top of the box and close by a reverse movement. The box and cover have each a jaw, between which the dovetail shaped heads of the tools will be secured, to be held for use when the box handle is closed, and opened to release the tools when the handle is opened. By the same operation by which the tool in use is released to be taken out, the box is opened to receive the tool to be changed and allow of taking out another, thus economizing labor and time. A spring catch is used to fasten the box closed.

Improved Beer Cooler.

John Chandless, New York city.—This invention relates to a new apparatus for cooling ale, and has for its object not to destroy the vitality of the ale while cooling it. A box or tank, of suitable size, is arranged to contain ice and water, and so serve as a refrigerator. A zigzag or coiled pipe is contained therein, its upper end projecting above the top and terminating in a funnel or enlargement. The lower end of the pipe extends through a side or the bottom of the refrigerator, and has a cock whereby it can be closed or opened. Being surrounded by ice water the pipe is necessarily cool, and will serve to cool whatever liquor may flow through it.

Improved Cultivator.

William T. Parker, Verona, Miss.—Two "scutic" plows are framed together, with the side pieces of the frame of the machine near the rear ends. The side pieces of the frame are jointed to cross pieces so that they can vibrate to allow the plows which are guided by handles to be brought toward or from the row, as may be demanded by the condition of it. The two sides of the frame are prevented from shifting forward or behind each other by suitable means. A vertical bar, rigidly connected to the side piece, rises from each, to considerable hight near the center, and, being connected by the cross bars loosely jointed to it, assists in keeping the frame in proper shape while allowing the plows to be vibrated. The rear support for the shaft to elongated vertically to allow the hight of the choppers to be regulated to the ground along which they run.

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Improved Key Ring.

William T. Jenks, Toledo, O.—This invention consists in a key ring, formed, as to its main portion, of one piece of metal, bent into a circular form, with its ends nearly meeting, and, as to its supplementary part, of a pivoted clasp, which fits in a depression formed by notching said ends, so that it will perfectly coincide with the inner and outer edges of the ring, and thus form smooth or continuous surfaces.

Improved Seed Planter.

Thomas C. Garlington, La Fayette, Ala.—The improvement in this invention consists in the use of stirrers which are made like augers, to the shafts of which are attached fingers, which are made of the same curve as the thread of the auger like part, so that they may clean themselves as they revolve. To the upper ends of the shafts is attached gearing, so that the stirrers may be driven by the advance of the machine.

Improved Wash Boiler Attachment.

Richard B. Hart, Salado, Texas.—This invention has for its object to furnish an improved steam washing device. In using the machine, the clothes to be washed are arranged loosely upon a false bottom around tubes. As the water begins to boil, the hot water and steam are guided by funnels into the tubes, up which they are forced into the horizontal pipe and are projected through small pipes upon the clothes. The water passes down through the latter, carrying the dirt with it, through the holes in the false bottom and through the holes in the rims of the funnels back into said funnels, and thus the circulation is continued until the clothes are clean.

Improved Stove Grate.

John R. Stone, Round Grove, Kansas.—The grate is suspended at one end by a yoke extending down through the top plate and having notches above the plate to be engaged by vibrating buttons, the ends of which swing into and out of the notches, as required for shifting the yoke high or low. Near the other end it is mounted on the end of a crooked lever, extending through a hole in the side of the fire box, which serves as the fulcrum of the lever. Outside of the fire box is a pawl, pivoted to the lever a short distance from the side of the fire pot, and engaging with the notches in the stove side plate above the lever. By shifting this pawl from one to another of the notches, the grate can be raised or lowered.

Improved Harness Maker's Gage.

Dewitt G. Garlock, White Cloud, Kansas.—The object of this invention is to furnish improved means for cutting leather and similar material into strips; and it consists in the screw for moving the head and handle of the gage. A slotted bolt is made to slide on the gage bar, the end of which enters one of a number of holes in the wheel when the gage head is adjusted, and thereby holds the screw and head stationary. This bolt is confined to the under side of the bar by means of a slot and screw and the box through which the bolt passes.

Improved Car Coupling.

Casper S. Bigler, Harrisburg, Pa.—This invention has for its object to furnish an improved car coupling which will enable the attendant to couple the cars after they have been run together, and to uncouple them while under strain, so that the attendant may be in no danger while coupling and uncoupling the cars. The draw hook is connected with the body of the car in the ordinary manner, and should be of such a length that there may be a space of an inch and a half, more or less, between the hooks of adjacent cars when their bumpers are in contact. In the body of the hook is formed a long slot, through which passes one end of the link which is dropped over the hook of the adjacent car to effect the coupling. A pin passes down through the slotted body of the hook and through the link to sustain the draft strain. The lower part of the pin, against which the link rests when sustaining the draft strain, is made tapering. The upper part of the pin may have a screw thread cut upon it, so that it may be moved in and out by turning it. The taper of the pin enables it to be readily drawn out even when the coupling is under strain, so that the link may be slipped forward and raised over the hook of the adjacent car without moving the engine and cars. This construction also prevents the cars from becoming accidentally uncoupled, as the link will not rise over the hook of the adjacent car when it can slip back in the slot.

Improved Process of Polishing Wood.

Christian Seebach, New York city.—This invention consists in the application to wood surfaces, which are to be polished with shellac and varnish of a preliminary coating formed of plaster, paint, and turpentine. The invention thus provides a means of closing the pores of wood preparatory to polishing. For a first coat, paint mixed with plaster of Paris and turpentine is laid on and smoothed down with a rag. When dry, a coat of shellac is applied, which, after being rubbed down in the usual manner, is covered with varnish and polished.

Improvement in Propulsion of Cars.

Raphael De Leidi, Brooklyn, N. Y.—This invention relates to a new arrangement of means for propelling vehicles in either direction over a given track; and consists in making the track of jointed sections, which are pivoted to supports in such manner that, by alternately inclining the several sections in opposite directions, the load supported on the track will be caused to travel from one section to the other until it arrives at its destination.

Improved Animal Trap.

Emile Achilles Cordeiro Da Silva, New York city.—The object of this invention is not only to provide an efficient trap for catching rats and other animals, but to make a trap which shall be self-setting, and consequently always ready; and it consists in a box, of oblong or other form, a portion of the top of which is pivoted to the sides, and nearly balanced on its pivots with an inclosure or bait chamber above said top, and with one or more inclines by means of which the animal is enabled to reach the top of the trap.

Improved Bale Tie.

Peter K. Dederick, Albany, N. Y.—The essential feature of this invention is a metal tie piece for the fastening of a wire band, so contrived that the longitudinal strain of the band causes the tie piece or plate to fasten the band by securing it between said plate and one or both of the taut portions of the band.

Improved Eccentric Fastening for Boxes, etc.

William Youngblood, Brooklyn, N. Y., assignor to Rossbelle Youngblood, of same place.—This invention consists of a circular disk or button catch, of metal or any other suitable substance, pivoted at its center to the side or top of the box or other thing to be fastened, and having a circular groove in the face fronting the box arranged eccentrically to the pivot, so that the hook or hasp of the box cover which drops into it through a radial notch will be pulled down and fasten the cover down tight when the catch is turned. The said radial notch is arranged where the groove is furthest from the center pivot.

Improved Medical Compound.

Joseph Gecmen, New York city.—The object of this invention is to provide a remedy for rheumatism and kindred diseases; and it consists in a compound composed of prunes, oil of cedar, chloride of sodium, sal niter, and juniper berries. These substances are thoroughly mixed together by adding cold water and combining them so that the salts named will permeate the whole mass.

Improved Gas Lighting Torch.

Charles H. Roberts, Troy, N. Y.—This invention is an improvement in gas lighting torches, and consists of a tube provided with perforations and a cup shaped end and attached to a staff, so as to conduct a stream of gas from the burner to the wick of a lamp or taper which is attached to said staff.

Improved Hat and Coat Hook.

Charles G. Cole, Bennington, Vt.—This invention relates to a new hook for clothes or other purposes, which is made of one single piece of wire or band of metal, and which has fastening points formed at its ends, so that it can be secured in wood without any other fastening device, rendering the cost of manufacture very small.

Improved Swing.

Edward A. Tuttle, Williamsburg, N. Y.—This invention has for its object to furnish an improved swing for children, which shall be so constructed that the seat of the swing, throughout the whole extent of its vibration, may be close to the ground, thus obviating the danger of injury from an accidental fall from the swing.

Improved Hat and Coat Guard.

Sumner N. Robbins, New York city.—The object of this invention is to supply to the public a device by the use of which the annoying change or carrying off of hats, overcoats, satchels, etc., may be effectually prevented. The invention consists of two U shaped metal hooks, which are connected by a small lock applied to one of them, and are adjusted to the brim of the hat or garment. A short guard chain may further connect the two hooks, to be placed around any fixed body, such as overcoats, satchels, umbrellas, or other objects.

Improved Valve for Gas Regulators.

John C. Sarsfield, New York city.—This invention has for its object to furnish an improved self-acting valve for regulating the pressure and flow of gas as it passes from the meter to the burners, to cause each burner to give the proper amount of light, however many or few burners may be burning, and it consists in a tubular chamber, designed to be connected with the gas pipe leading from the meters to the burners. The chamber consists of two parts which are screwed together. The flanged end of a tube has a screw thread cut upon its outer surface to screw into a screw thread cut in the inner surface of the mouth of the main part of the tubular chamber. The hole through the flanged end of the tube is closed with a valve, which rests upon the outer or forward side of the said flange, and the forward end of its stem passes through a guide hole in an arm formed in the cap part of the tubular chamber. The other end of the valve stem passes into the tube and has one end of a coiled wire spring attached to it. The other end of the spring is attached to a cross bar which rests in notches formed in the edge of the open end of the tube. In the edge of the open end of the tube, midway between the notches, are formed two other notches, which are made deeper and wider than the first notches, so that, by raising the cross bar out of the latter, it may be changed in its position and thus change the tension of spring.

Device for Converting Circular into Reciprocating Motion.

Luther Dame, Newburyport, Mass.—The object of this invention is to convert circular motion into reciprocating by means of a simple device which works without jar or noise, producing only a very slight degree of friction. It consists of a hollow cylinder with a longitudinal slot, into which a cylindrical core is closely fitted, gliding therein by means of a bolt connected with the core and running in the slot, applied eccentrically to a face plate or shaft turned by a crank or other suitable arrangement. The mechanism is simple, not liable to get out of order, and has but little friction. We think the invention well adapted for driving light machinery. We shall probably present an engraving of it in an early number of the SCIENTIFIC AMERICAN.

Improved Boring Machine.

Isaac Cory, Dalton, Ind.—The object of this invention is to produce a boring machine whereby trees whose sap is to be obtained in the manufacture of sugar, turpentine, resin, or for other purposes, can be conveniently tapped; and the invention consists in applying a rotary tool or auger to a movable frame, which can be fed against the tree while the auger is being rapidly revolved by hand or other means.

Improved Lantern.

Seymour Hughes, Jersey City Hights, N. J.—The object of this invention is to simplify the construction of lanterns, and to reduce the expense of making the same, and of keeping them in repair. The improvement consists in constructing the crown or upper metal portion of the antern with a view to allowing the ready removal and insertion of the glass, which may be simply a common lamp chimney.

Improved Screw Propeller.

Martin M. Wilson, Honey Grove, Texas.—This invention consists in means for guiding pivoted propeller blades so that they can open and close readily and uniformly. It also consists in a new mode of applying a spring thereto so that the obliquity or resistance of the blades will be automatically graduated. When the vessel is loaded and the resistance on the blades is increased and a finer pitch required, the spring will contract in proportion to the resistance, and the pitch will be changed as demanded by the amount of the load, and the slip will be proportionately lessened. At the same time, the propeller will have the same effect upon the engine as a marine governor to regulate its speed. The tension of the spring will be varied as required by an adjusting nut. This arrangement of variable blades and a spring is claimed to afford a gain or saving of power, and consequently of fuel, under any circumstances, whether the boat is light or loaded. These variable propeller blades are applicable to vessels of all kinds using screw propellers, whether for canal, river, lake, or ocean navigation.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents.*

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate. Address MUNN & Co., stating particulars.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, for full particulars.

Design Patents.

Foreign designers and manufacturers, who send goods to this country may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row New York.

Canadian Patents.

On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee or $20) for ten years (government fee $40) or for fifteen years (government fee $60) The five and ten year patents may be extended to the term of fifteen years The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish full instruction.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent. Address MUNN & Co., Patent Solicitors, 37 Park Row, New York city.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an *honest opinion*. For such consultations, opinions and advice, *no charge is made*. Write plain: do not use pencil, nor pale ink be brief.

All business committed to our care, and all consultations, are kept *secret and strictly confidential*.

In all matters pertaining to patents, such as conducting interferences, procuring extensions, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information, and for pamphlets of instruction and advice

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Belt Hook—For the best Belt Hook for Rubber or Leather Belts, address Greenleaf Wilson, Lowell, Mass.

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Edge Tool Makers' Grindstones, Mitchell, Philadelphia, Pa.

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All Blacksmith Shops need a Holding Vise to upset bolts by hand. J. R. Abbe, Manchester, N. H.

Parties desiring Steam Machinery for quarrying stone, address Steam Stone Cutter Co., Rutland, Vt.

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Steam Boiler and Pipe Covering—Economy, Safety, and Durability. Saves from ten to twenty per cent. Chalmers Spence Company, foot East 9th St., New York—1202 N. 2d St., St. Louis, Mo.

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Key Seat Cutting Machine. T.R.Bailey & Vail.

Tree Pruners and Saw Mill Tools, improvements. Send for circulars. G.A.Prescott, Sandy Hill, N.Y.

Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24 and Nov. 20, 1869. 64 Nassau St., New York.

Five different sizes of Gatling Guns are now manufactured at Colt's Armory, Hartford, Conn. The larger sizes have a range of over two miles. These arms are indispensable in modern warfare.

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Gauge Lathe for Cabinet and all kinds of handles. Shaping Machine for Woodworking. T. R. Bailey & Vail.

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All Fruit-can Tools, Ferracute, Bridgeton, N.J.

For Steam Fire Engines, address R. J. Gould, Newark, N.J.

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Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

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Spur and Bevel Wheels and Spindles, of great durability, cast to order by Pittsburgh Steel Casting Co. All work warranted.

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The best Lubricators, Oil Cups, Gauge Cocks, and Oil Cans, are "Broughton's." Circulars sent on application to H. Moore, 41 Center Street, New York.

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Arrangements are being made to manufacture a small oscillating engine for the use of farmers and others requiring a little power, but whose limited means and knowledge of the Steam Engine prevent them from buying the more expensive and complicated machines. Agents are wanted now to sell models made under the same patent. E. P. Ryder, 19 Ann St., New York.

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Steel Castings "To Pattern," from ten lbs. upward, can be forged and tempered. Address Collins & Co., No. 212 Water St., N. Y.

Notes & Queries

A. P. asks how to temper steel dies and punches.

F. E. C. says: How can I make translucent cloth for hotbed frames?

E. F. S. asks how to prevent soft metals such as tin, lead, etc., from clogging files.

W. M. asks: When and where were bolting machines first introduced for bolting flour?

S. A. L. asks: What kind of leather is generally used in making blacksmith's bellows?

M. C. asks: Can a card be saturated with phosphorus and preserved for use, and will it be flexible?

P. R. R. asks: Can any of your readers describe a process for tempering steel springs by compression?

A. L. asks: What is the best wood to make insect cabinets of, and what is the best form for the same?

W. H. H. asks: Can you tell me how to make a pickle for taking sand off castings, such as small gear wheels, etc.?

J. F. A. wishes to know with what material he can coat the inside of tin cans, to prevent ink and other fluids from being affected by the tin.

E. D. R. asks: What is the best method of mixing fresco colors, and what ingredients are used to make them flow freely and cover well?

C. M. asks: How can the glue joint between the back and sides of a violin be undone without injuring the instrument or spoiling the varnish?

E. B. asks for a recipe for making dextrin or a substitute for the same, say 50 lbs. at one time. He wants to use the dextrin for sticking purposes.

W. S. B. asks: What is meant by summer and winter strained lard oil? What process does the lard go through to keep it from congealing?

C. B. asks if there is any method of toughening or preparing wax for flower making so that it will not be liable to soften in warm and harden and crack in cold weather.

J. D. asks for a recipe for a waterproof liquid cement, to be used for putting patches on bags, in the place of thread. It would be very useful to thousands of farmers.

G. M. D. says: How can I mark or print letters and figures on metal that has been finished and plated with silver? I have seen such work, but cannot tell how it is done?

A. P. asks: Will the power of a 10 horse engine drive a machine or machinery 100 feet away from the engine as easy as it would 10 feet away? The machinery is to be driven by a belt or belts from the line shafting.

N. J. J. asks: What kind of fish would be best to raise in a lake one mile in diameter? The water is eight feet deep, and the lake has no visible inlet nor outlet. The water is at all times bright and clear and has an agreeable taste.

J. R. says, in regard to R. and W.'s query about the balance wheel: Supposing that W. is right, will he be kind enough to explain the action of the gyroscope governor, illustrated and described on page 134 of the current volume of the SCIENTIFIC AMERICAN?

C. E. C. says: Can some one give instructions for annealing gold so that it can be conveniently worked into rings, drawn into wire, etc., without cracking? I am often troubled with gold coin and good scraps, which are as brittle as cast iron.

J. C. K. asks: What is the best preparation for setting the thimble skein on axles? I use the dregs of paint heated over a slow fire to the consistency of a batter. Is there anything better? In large wagon factories, how do they cut out the hub for the thimble box?

G. D. N. asks: Is there any work published treating wholly or in part upon electro-magnetic motors? Where can it be obtained? Is vulcanized rubber or dentist's hard rubber a conductor of electricity? What is the necessary size of a battery to ring a bell? It must be active for a month.

P. L. says: We use equal parts of first quality clay and ground brick in the manufacture of our retorts for distilling phosphoric acid; and yet they sometimes crack over the heated furnaces. We manufacture them in a warm room, fire the kiln with care, and subject all to the same charges, heat of flame, etc. What is the cause of our trouble?

D. H. E. says: I have lost the sliding weight to my platform scales, commonly called the P. The lever is graduated from 0 to 100 lbs. in half pound notches, and there are additional weights, 100, 200, 300, and 400. There is a cup at the end to put shot in to keep the balance; but it has been emptied also, otherwise I could easily put on the platform U. S. standard weights and make my new lead P of the right weight. Please tell me how to get it to the proper weight.

H. A. B. asks: What proportion of burnt clay should be mixed with quicklime to form a hydraulic cement? The lime is to be measured before slacking, the clay after grinding. Should the clay be burned in a very hot fire and how long should it be exposed to the heat? Of soft magnesian limestone and American chalk, which would make the best lime, and what would be the relative quality of each?

J. R. has read Professor Young's lecture on our present knowledge of the sun, and asks for explanation on the following point: The professor asserts that a contraction of the volume of the sun, equal to 240 feet of its diameter, would account for all the heat it gives off. "If we freeze a pail of water, it gives off heat while it is freezing, but the thermometer will indicate no fall of temperature, until it is all frozen." The greatest density of water is at a temperature of 39° Fah.; and if it becomes colder, it expands, in contradiction to the fact quoted by Professor Young. How is this?

J. R. asks: What are the limits of expansion in an engine provided with an ordinary D valve in the steam chest? The admission of steam is cut off by a plate valve (sliding over the opening which admits the steam into the steam chest). The D valve is connected in the same way as in an ordinary engine; the plate valve, however, is worked by a crank pin of a wheel which makes twice as many revolutions as the shaft of the engine. The main valve has 1-16 of an inch lead and ¼ inch outside laps. The steam port and the said opening are ¾ of an inch wide and both valves have 2½ inches throw.

D. F. says: We use what is called a gas pump in our oil well to draw gas up through the large casing between it and the tubing. What will be the difference in the amount of vacuum created by a ten inch cylinder and by a fourteen inch? They are piston pumps. How many lbs. per square inch would the vacuum be for each pump? They would both be acting on a tight vessel.

T. K. B. says that polished steel becomes in a manner scaly, after being hardened, by the cold air striking it. "I use soap to coat the steel with, still it does not overcome the difficulty perfectly. I am told there is a liquid for coating steel, while heating it, in such a manner that the cold air does not strike it. I would be obliged to you or some of your readers for a process better than the soap."

Answers to Correspondents

T. P. says: In your answer to F. E. D. as to fitting up cones so that the band will be equally tight on all the pulleys, you say that the sum of the diameters of all the pulleys will be the same. In my experience I find that steps in cones made all the same will not do. Please explain. Answer: For crossed belts the sizes will be the same. This is what we there stated. Read the reply more carefully.

M. J. B. says: Please state which is the most perfect book on mineralogy, and where it can be obtained. What is the price of it? Answer: Get "Dana's Mineralogy" of your bookseller.

E. A. P. sends a description of parhelia and asks for explanation. Answer: This phenomenon was explained, on page 132 of our current volume, as due to floating crystals of snow or ice in the air; and the same explanation would apply in the present case. The prismatic effects at noon were probably not so fine as they would have been with the sun nearer the horizon.

A. G. F. says: I have occasion to run a hydraulic press at a distance of 250 or 300 feet from the power which runs the pumps. Can I not dispense with the shafting, place the pumps near the engine and use an enlarged pipe for connecting the pumps with the cylinder of the press, without material loss of power? Can I use a pipe 250 or 300 feet long, and if so, what should be the relative increase of size of pipe for 300 feet over the size required for 10 feet? Answer: You can dispense with the shafting and set your pumps near engine, using a pipe to conduct the water. You need not increase the size of the pipe. The supply of water is so small that an enlargement of the pipe is unnecessary for so short a distance as 300 feet.

J. F. C. says: 1. What convexity should a pulley have to allow a belt to run and adhere to its best advantage? 2. Is it best to run a thin and broad belt or a thick and narrow one? 3. Is it best to run one broad belt of sufficient capacity to convey the power of the engine: or would it be better to divide it and run two of half the width each? Answer: 1. One half inch to a foot in breadth of face. 2. A thin belt up to a breadth which will render it unmanageable. 3. That would depend upon the amount of power to be transmitted. For a thirty horse power engine, we should use a single belt of full width, if certain that it would be kept properly laced or otherwise well secured to take even strain across its full breadth.

A. T. Z. says: I have a turbine water wheel of 16 horse power driving a run of stones. Upon the top of the upright shaft of water wheel was a pinion 16 inches diameter and 2 inches pitch, with iron teeth, driving one of 2 feet diameter with wooden teeth on the stone spindle, giving proper speed to stones, but making a jarring noise in the teeth and shaking the building. Thinking the pitch too large for the diameter of wheels, I made, very correctly, new patterns, with 1½ inches pitch and the same diameters as before, but found them work no better. Can wheels of above sizes be made to drive a run of stones and work smoothly? If so, what is the cause of the trouble with mine? Answer: We are inclined to think that your trouble is due to want of proper balance of your turbine. Wheels of the sizes mentioned can no doubt be made to run smoothly.

W. H. M. asks: If a pump of 2 inches diameter has a stroke of 3 feet, what amount of water in cubic inches does it draw, and what is the rule for finding the same? Answer: To find the area of a circle, multiply the square of the diameter by the decimal .7854. To find the cubic contents of the cylinder, multiply the area by the length. In your example 2×2×.7854×36=113 cubic inches of water and a little over, for each stroke.

H R. asks: Can you inform me of what materials the elastic rollers used on printing presses are made? Answer: Glue and molasses. Increase the quantity of glue to make a stiff roller; you will need this in hot weather.

M. M. T. asks how glass becomes porous, if it ever is so. Answer: All glass is more or less porous. Some coarse bottle glass is so much so that it will not insulate for electrical purposes.

J. F. C. says that G. T. P. can make the best red sealing wax by mixing 1 lb. shellac, 1 lb. Venice turpentine, ½ lb. chalk and ½ lb. English vermilion.

H. P. has an aquarium made of a wooden frame and glass sides, and wants a cement to make it watertight. Answer: Mix equal quantities of dry white lead and red lead in a paste with mastic varnish. Use as soon as mixed.

W. E. A. says: I have a plan for taking water through the surface condenser of a marine engine by which the motion of the vessel is made to perform the duty of the circulating pump now used. Is there, to your knowledge, any thing of the kind in use? Answer: The plan has been often suggested and more than once tried in various forms. Success has not been met with in any case in such a degree as to lead us to anticipate its general adoption.

C. E. C. asks how to mend rubber boots. Answer: See page 165 of our volume XXVI.

J. H. W. says: I have seen it stated somewhere that the workmen in deep mines were entirely unaware of the occurrence of the severe shocks of earthquake which were felt last fall in California: and, as so many theories have been promulgated to account for these phenomena, I have been expecting some of the scientists to base—if this statement be correct—a more probable theory upon it. If true, it would indicate, of course, that these disturbances are created upon or very near the surface, and the old doctrine of internal commotion (gaseous or otherwise) causing upheaval of the crust, a doctrine still held by many, would be untenable. Answer: The statement that the workmen in deep mines were unaware of the shocks and undulations taking place on the surface would require the concurrent testimony of numerous witnesses before any scientific men would put any confidence in it. It sometimes happens that, owing to great geological faults and fissures, the earthquake waves are not propagated over small districts of country: they remain like islands in the raging sea. This fact has several times been noted, but in such cases there is no motion either on the surface or in mines. That there should be wave motion on the surface and none at a moderate depth below, is in the highest degree improbable; on the contrary, animals living in caves and holes are the first to perceive the shock, and often give note of an approaching earthquake by rushing to the surface.

J. E. M. asks: Does heat or cold affect the power of a magnet; also whether the movement of a piece of steel would be more rapid towards a strong magnet than towards a weak one, provided the same piece of steel be placed at the same distance away from each? I think that the stronger magnet would attract a larger piece of steel than the weaker one; but under the above named conditions, the movement of a piece of steel would be just as rapid towards the weaker as towards the stronger one. Am I right or wrong? Answer: Alternations of heat and cold, sudden contraction or expansion, and percussion are decidedly injurious to the strength of a magnet; and we should say that a powerful magnet would attract a given piece of steel towards it more rapidly than a weak one. Better try the experiment.

F. G. asks: How can I make a good and cheap electric battery? Answer: You can buy a battery cheaper than you can make one, but if you wish to try your hand at the business, we can recommend what is called Daniell's pattern as being easy of imitation. Make yourself a copper cup of the capacity of a pint measure, and a second cup, holding a gill, out of sole leather. In the copper cell, put a mixture of eight parts of water and one of oil of vitriol, saturated with blue vitriol, and pour some of the acid water without the copper into the leather cup. Cast a solid cylinder of zinc and amalgamate it; plunge this into the inner leather cup and connect it by a copper wire soldered to it with the outer cups. Several of these cups would constitute a battery. Now read about it in your school philosophy, and you will learn what further to do.

H. R. asks: 1. Is there any glue or substitute for the same that will stand exposure to wet weather? Answer: Take cacutchouc, 15 or 20 grains, chloroform, 2 fluid ounces; dissolve and add ½ ounce powdered mastic.

M. H. asks: What is the best way to fasten felt or any similar material to zinc? Answer: Try painting the zinc with a thick coat of white lead; let it dry and then use stiff hot glue,

F. W. D. says: Please enumerate the various colors of which white is composed, and the order in which they must be painted upon a circular disk, so that, when properly revolved, it will present a white surface. Answer: Divide your disk radially into five equal parts, and paint each of these with the seven colors of the solar spectrum, namely, violet, indigo, blue, green, yellow, orange, red. Put these colors on radially. Paint a black bull's eye in the center of the card, and blacken the circumferential edge. Revolve rapidly, and you will see only a grayish white instead of the colors.

F. C. asks if the borax treatment for preserving meat is detrimental. Answer: No.

J. H. J. Your plan for steam engine is old. Water colors are used for theatrical scenes.

A. P. should send his volumes for binding to our office. Charge, $1·50 per volume.

A. C. asks: I. Who designed and built the Thames tunnel (England)? 2. Who designed and built the Great Eastern? Who launched her? Answers: 1. Sir Mark Isambard Brunel. 2. Isambard Kingdom Brunel, son of the former. Built by John Scott Russell & Co.

Z. asks how to preserve natural flowers with wax. Answer: Take paraffin, melt it and dip the flowers in very carefully.

D. F. T. says, in reply to O. K., who asks if it is advisable to drive a 4½ feet millstone with a quarter twist belt from the driving shaft to spindle: From experience, I should say no, unless you use a long belt. Your belt should be 9 or 10 inches if you want it to do any work. [In our reply to O. K., we originally advised a long 8 inch belt. The figure was by mistake, printed 5 inches.—EDS.]

J. B. T. asks for a recipe for bluing gun barrels. Answer: See page 10 of our volume XXV.

W. T. B. says in answer to D. F. W., who asked how to cut a crack in a bell clean, to stop the discordancy: I have used a circle of common soft Russian stovepipe iron, running at a velocity of 5,000 revolutions, to cut teeth in a large saw. I could do it very quickly, but the under side of the saw was so hard that it could not be filed. It would cut the whole length of a twelve inch flat file in 1½ minutes.

J. W. K. encloses a mineral specimen found in limestone, and a black mineral, and asks what they are. Answer: The black mineral is very soft bituminous shale. The other is flint.

B. O. M. asks how to bronze cast iron brackets. Answer: Read Byrne's "Practical Metal Worker's Assistant."

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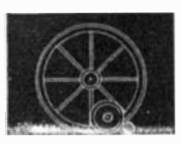
C. S. asks: Will you please send me the name of any work treating in detail on the construction of balloons? I wish to know of what quality of silk, the kind of varnish, formula for cutting the segments, etc. If it is feasible, I intend to construct a balloon capable of carrying 301bs. of apparatus, and make continual record of atmospheric phenomena, with the rise of a captive balloon at an elevation of 3,000 feet. Answer: General instruction in regard to form and material, cutting, varnishing the silk, with formula for weight in relation to bulk, etc., will be found in the article Aerostation in Good and Gregory's "Pantalogia," also, but not so full, in Vol. I. Partington's "Philosophy"; also in article Aerostation in Encyclopedia Londonensis; the last, perhaps, is the best. See also Simpkin's "Aerial Navigation," London, 1845; Wise's "Aeronautics," an American publication, and Glaisher's "Up in a Balloon." All of these books are probably in the State Library at Albany. Experiments with captive balloons sustaining self recording meteorological instruments would be full of interest. We fear, however, that the first heavy gale would sweep them away.

W. G. C. asks: Would it take more power to prevent water escaping by a ¼ inch hole at the bottom of a pipe, 6 inches in diameter and 100 feet high, filled with water, than it would require to prevent water escaping by a ¼ inch hole at the bottom of a pipe, ¼ of an inch in diameter and 100 feet high, similarly filled? Or, again, would it require a different power to prevent water from escaping from a ¼ hole at the bottom of a pipe 100 feet high, and tapering in its diameter from 4 inches at the top to ¼ of an inch at the bottom, the pipe being full of water? Answer: The required force would be the same in each case, as the pressure of a liquid at an orifice is proportional to the head of water above it, and bears no relation to the size or form of the containing vessel.

M. R. asks: 1. Will a horse pull a heavy load up hill easier on low or on high wheels, and why? 2. Weight of vehicle being the same, which pulls easier, a load divided over 4 wheels or over 2 wheels, and why? Answer: 1. Within ordinary limits, a horse should pull the heavier loads with high wheels, because in running over



A

an obstacle, as at A, the larger wheel distributes the forward effort to better advantage, in "prizing" itself and load over it, than does the smaller wheel. Should the horse be attached directly to very large wheels, by short traces or chains, there would be a tendency to raise him from his feet, and thus to prevent the effective application of his strength, which might, in extreme cases, more than compensate for the anticipated gain. 2. On soft ground, 2 wheels would cut in more than 4, the same load being carried, and thus would require more effort. On hard roads, we should expect 2 wheels to do best, as the weight of 2 wheels and their friction would be avoided.

H. B. J. sends a mineral. "I took it from a lump of quartz which was full of small seams and pieces. The specimen was originally larger than an egg. Is it copper?" Answer: It is a valuable copper ore, containing about sixty per cent of copper, the rest being sulphur and iron.

E. C. D. sends us a stone, and asks what it is and if it is an indication of coal in the vicinity. Answer: The specimen is carbonaceous shale, but it does not promise the existence of coal in the neighborhood, neither does it decide against it. A fragment of rock gives no evidence one way or the other, as the same rock is found both above and below the coal measures. The geological sequence of the strata must be observed.

I. P. H. sends us a mineral specimen found in hematite. He asks what it is, and if it will affect the iron in the blast furnace. Answer: It is an infusible argillaceous rock, and will simply increase quantity of slag.

C. G. C. encloses two samples of minerals and wishes to know what they are called in geology and of what they are composed. Answer: Both specimens are feldspathic products, the soft, pliable one being kaolin, much used in porcelain manufacture.

H. D. asks: 1. What is caustic ammonia and how is it prepared? What is the expense of it? 2. What is the cheapest way to manufacture hydrogen gas for balloon purposes? Answer: Caustic ammonia is the aqua ammonia of the druggist, and costs from ten to twenty cents a pound according to purity and concentration. It is manufactured by heating quick lime and sal ammoniac together and absorbing the gas in water as it comes off. The cheapest hydrogen upon the whole is made by acting upon scrap iron or zinc by dilute sulphuric acid. We advise our correspondent to read up on both these questions in almost any elementary treatise on chemistry.

T. H. P. says: Last spring we put up a small 7 x 12 engine, the boiler being an upright one, 6 feet high and containing 37 flues. We fed with cold water until winter, when the freezing of the pipes caused us to adopt another plan. We then placed our feed barrel below the level of the engine bed, and run the exhaust into the barrel to heat the water. This works very well so far as heating the water is concerned, but it has the disadvantage of collecting the tallow used for lubricating the cylinder; and after passing through the pump, it is forced into the boiler. We use neither filter nor mud drum. What would be the best way of cleaning this grease out of the boiler? How would it answer to use lye and convert it into soap, and then blow it off? If this would answer, how much ought to be used? What would be the best method of cleaning the feed pipes, which are coated inwardly with greasy matter? We want to use the boiler for about 6 weeks more, only. Answer: Try using crude mineral oil for lubrication, as recommended recently by one of our correspondents in this column. If that does not answer, we should use a worm heater. We should suppose that economizing in the use of tallow might give good results in more ways than one.

J. T. B. asks: 1. What is the proper rule for determining the sectional area for the rim of a fly wheel suitable for any power of engine? 2. What is the rule for determining the sectional area of a lever crank of any length, suitable for any given power or pressure on piston? 3. What is the rule for sectional area of an engine bed suitable for any pressure on piston, and any length of crank? Answers: 1. Answered in article on fly wheels, on page 177 of this issue of the SCIENTIFIC AMERICAN. 2. Multiply the pressure on the crank pin by the distance from the center of pin to point at which the thickness is required and by 17; divide the product by 100,000 times the square of the depth in a line perpendicular to both the lines of the shaft and of the crank. The result is the probable thickness of web with which a crank will just break. To be safe, take a pressure on the crank pin at least six times as great as the anticipated pressure. 3. Multiply the area of piston by the steam essure and divide by 3,000. The quotient will be the ast allowable sectional cross area of the bed.

C. S. C. sends a mineral specimen and would like to know its value and what it may be used for. Answer: It could be used in making brick and coarse pottery.

E. P. C. encloses four mineral specimens for examination. Answer: No. 1 is indurated clay. No. 2 is the same, but purely argillaceous. No. 3 is compact limestone. No 4 is siliceous limestone, containing minute crystals of pyrites. You have been boring through the Trenton or Lower Silurian limestone and entered the calciferous formation. You must be very near the granite or underlying rocks. If you do not strike water the moment you reach these, you should give it up. We presume the strata in your region dip southeast; but not knowing their precise disposition at Wequiock, it would be idle to prophecy at this distance. Keep on till you touch granite.

E. B. asks: 1. If the spectrum of iron shows 65 lines, does this indicate that iron consists of sixty five terrestrial elements? 2. Can it be ascertained what particular line the color substance of flowers and leaves will throw in a spectrum, by burning leaves, etc., in a fresh state? Answer: 1. It is generally supposed that the number of lines and their position in the spectrum is characteristic for each metal. All of the iron lines belong to iron, the potassium lines to potassium, etc. The number and location vary for each metal. There are only 65 terrestrial elements, all told, and iron is one of them. 2. The absorption bands produced by the coloring matter of plants have been studied and described by different authors. When the leaves are burnt, the coloring matter is destroyed, and the lines on the spectrum are there produced by the mineral constituents of the ashes.

H. N., Jr., asks: What will remove red ink from writing paper? Answer: The red ink is readily removed by hydrochlorite of soda, which can be purchased under the name of "Javelle water." Chlorine water and a solution of bleaching powder will also destroy the color.

J. H. S. asks: Where can I find a reliable mechanic's companion? Answer: See our advertising columns.

H. A. W. says: In this county, Edgecombe, N. C., there are many locations in which accurate surveying cannot be done in the ordinary way with a compass, on account of the great variation of the needle, due to local causes. These difficulties are most generally met with in the neighborhood of marl beds; and a variation of one half degree in stations but a few yards apart is not unusual in attempting to run lines in close proximity to one of these beds. With only one exception, I have always found marl in locations where the needle was seriously affected. This is a flat sandy country, and no iron ore was ever found in it, to my knowledge. The true explanation of this variation of the needle is of practical importance to the people of this section. Marl is of great value as a fertilizer for our lands; and if the fact could be established that the mineral deposits, causing this variation of the needle are found in all marl beds in this section, and only there, then much trouble and expense incurred in looking for marl deposits might be saved by the use of proper instruments. Answer: The deviations of the needle, are some times due to magnetic currents in the earth, but more generally to deposits of iron. Any marl that acts on the needle in the manner described must contain considerable iron, or there may be beds of iron beneath it. It is not probable that a "diviner's rod" or any kind of instrument can be devised for pointing out marl; but in mineral explorations for iron the magnetic needle has been successfully employed by Major T. B. Brooks, of Michigan. This explorer, who has had great experience in the use of the compass, thinks that the thickness of rock or earth which covers the iron deposit may be determined by using a dip compass and solving the triangle thus observed. While the deviations of the ordinary needle compass are so great as to interfere with the accurate running of lines, the solar compass, invented by Colonel Burt and used in all the western surveys, can be employed.

W. M. K. says: It is a well known fact that musical notes are produced by the regular vibrations of the air, so many vibrations in a given time producing a given note; and the higher the number of vibrations in a given time, the higher will be the note produced. These notes of different degrees of hight and duration, combined and arranged in certain ways, compose music; and these vibrations acting on the nervous system through the organs of hearing are capable of producing various emotions. As these effects are produced by vibrations acting on the nervous system, would not the same results be obtained by electric shocks acting on the nervous system and corresponding in number and arrangement to the vibrations of the air? Has the subject been experimented on, and with what results? Answer: In the mechanism of the ears, there are a great number of nerve filaments which traverse the organ and are known under the name of Schultze's bristles. These slender threads catch waves which come to them with the rapidity of rifle bullets and render the vibrations fit for reception by the brain. There are 3,000 bristles, each one of which has its own pitch and is thrown into vibration when the proper note reaches it. It does not follow that electricity could be interpreted by the same apparatus, unless sound was produced. Electric shocks are one thing, sound waves are quite another, and there is probably no analogy between them.

C. E. says: Will some surveyor, civil engineer, or astronomer please inform me through your columns the difference (by actual observation) between true north and magnetic north, for this year, in the city of New York? The variation changes from year to year, and day to day, and our correspondent can determine it for himself with a theodolite according to instructions given in books on surveying.

W. C. A. says: When it is stated that a book is 8vo., how am I to know length and breadth in inches, thus impressing upon my mind the size of the book? Answer: Usual 8vo size is 9½x6 inches or a little less. Royal 8vo. is about 11x7, but it may be a little smaller or a little larger.

G. B. L. asks: 1. Are inserted teeth, for circular saws for sawing logs into lumber, better than solid teeth? 2. Can the number of teeth in the saw be diminished, say to one fourth or one sixth of the number generally used, with good results? 3. When the lower half of a cylindrical boiler only is exposed to fire and the lower water gage is half the radius above the line of fire surface, is there danger of explosion should the water fall below the lower gage, unless it falls below the line of exposure to fire? In other words, can water be converted into an explosive gas, under the circumstances described, the heat being transmitted to the water line through two or three courses of brick? Answers: 1. Inserted teeth are largely used and, properly constructed, are found advantageous in ordinary work. 2. We are hoping to obtain the results of experiment on this point, and are as yet unprepared to give a satisfactory answer. 3. No.

D. M. C. says, in reply to H., whose horses are troubled with corns: I am a horse shoer and have had some experience with corns in horses' feet, and think the cause is the shoe bearing too hard on the heel. I treat them with the best success by taking a farrier's knife, and cutting them out, as deep as possible, without cutting to the quick; then, holding the foot upside down, I put in a few drops of turpentine, holding it a few minutes to soak in. Then I take oakum soaked in tar and fill the hole, to keep out dirt and gravel. Fit the shoe with a stiff heel, so that it will not bear on the heel of the foot. Corns seldom trouble after being treated in this manner, and soon disappear entirely.

H. S. T. replies to A. H. S., who enquires for a rat and mouse proof filling for his walls: I have seen dry saw dust used with every success; the vermin soon get disgusted in trying to get through it. It is also the best thing that can be used to guard against cold.

A. W. T. says, in reply to H. J. H: To give metal articles a lustrous black coating. The inside bottom of a cylindrical iron pot, about 18 inches high, is covered half an inch thick with powdered bituminous coal. A grate is then put in and the pot filled with the article to be varnished. The lid is then put on and the pot heated over a coke fire. When the bottom of the pot has been heated for fifteen minutes, the coal has been mostly converted into coke. The pot is then removed from the fire, and, after standing ten minutes, it is opened for evaporation and the articles will be found coated as desired. This coating will stand considerable heat, and disappear at beginning of redness. It is adapted for iron, steel, tinned iron, brass, zinc and pottery. Smaller articles like hooks and eyes may be coated by heating them, in a sheet iron drum like a coffee roaster, with small pieces of coal until they present the desired appearance.

W. G. W. says that S. W. P., who enquires on page 154 about learning phonography, should go to the fountain head for the surest instruction. The inventors' own pure and simple system is the easiest to learn, the most reliable in reporting, and is unmistakably legible in every word. His name is Isaac Pitman, Paternoster Row, London, and his books can be obtained through any bookseller. "The system is taught in my neighborhood very successfully, and is being introduced into the junior schools as an eminently useful educational auxiliary."

B. G. replies to J. S. L., who wants to know how to have good water in his well: I have the best pump water in the neighborhood; my plan was the following: Empty the well, suspend (by a string) a coarse canvas bag, with three or four good sized lime stones and one or two lumps of charcoal in it. Have the string long enough to nearly reach the bottom of the well. In a week or two, take out the charcoal, throw back the lime stones into the well with five pounds of soft coal. Put a round or square wooden shoot up at the back of the pump; carry the shoot up higher than the pump for free ventilation. If the pump is out of doors, put a "tee" on top; if under cover, a fine wire gauze will do. J. S. L. can cover up his well, and I think he will have no more trouble in getting a drink of good water at home.

W. T. B. says, in answer to D. H. S., Jr., who asked how to remove the taste of smut from wheat: To remove taste and smell from smutty wheat, dry your wheat thoroughly, so that the dust of the boll, when broken, will not adhere to the grain. Then run it through your smutter, and back your bins, and, if the air does not purify it in a few days, sprinkle on as much water as you need to toughen the hull of the wheat before grinding, adding one part bromo-choralum to twelve parts of the water.

W. T. B. says, in answer to O. K., who asked if a burrstone could be driven with a quarter twist belt direct from shaft to spindle: I have used the quarter twist belt direct from shaft, for running millstones, successfully. But for 4½ feet stones, I used a twelve inch belt, which I think small enough for the capacity of that sized stone, namely, 25 bushels wheat or 50 bushels corn per hour. The distance between shaft and spindle was twenty feet.

J. M. says that D. can color his extract of lemon with tincture of curcuma. The tincture can be made by putting 1 ounce pulverized curcuma in one pint alcohol; mix, and it is ready for use, but it becomes stronger by standing. Half an ounce of the tincture is sufficient to color one quart of the extract of lemon.

P. A. B. says, in answer to F. C: Heat your screw driver to a cherry red heat, to two inches from the end. Dip in cold water one inch, then rub the point on a piece of brick or anything that will make it bright. When the color at the point comes to a light blue, dip in water.

N. J. F. says, in reply to P., who asked how to make Grecian paintings: Mix equal parts balsam of fir and common turpentine (both should be colorless); shake well and put away in a warm place for a day or two, shaking occasionally. Select a photographic portrait with clear lines and soft shadows, put it into water for a few hours, when the photographic print, if mounted, can be removed from the card. Wipe the paste off carefully and wash well. Then to each side and to the top and bottom, paste strips of paper; the edges should lap very little. After the paste has dried and the strips adhere firmly to the photograph, place the latter in the center of a frame or stretcher, to which paste the other ends of the strips of paper. This suspends the photograph in the center of the stretcher. Then with a large soft brush dipped in spirits of turpentine, moisten the back of the photograph and immediately pour on the varnish above described; rub it with the finger over the entire surface of the back and continue to do so till the picture is seen as distinctly on one side as on the other. Then put away to dry where no dust can mark it. When perfectly dry, prepare a pallet of oil colors mixed with poppy seed oil (to prevent drying too rapidly). Then on the back, lay the hair color smoothly over the hair, the flesh color smoothly over the entire face, excepting the eyes and lips; over the eyes put pure white, over the lips the proper shade of red. Paint the drapery according to fancy, allowing for the colors to sink in drying. When perfectly dry, if cracked, go over again with the same colors and shades; if not cracked, paste (with common flour paste) smoothly to a piece of card board; press till dry, then sponge the face, and, with a little clarified linseed oil on the tip of the finger, go over the picture. Prepare a pallet of colors for the finishing touches. Deepen the shadows, raise the high lights, put a natural flush on the cheeks, paint the pupils of the eyes the proper color, put in the light with pure white, deepen the shadows and raise the lights of the hair. Give a few spirited touches about the lips and mouth, touch up the drapery, and you have "a thing of beauty" which will be a "joy forever." I neglected to mention that the background should be painted on the back of the picture and the whole surface of the back covered with color before it is pasted to the card board.

A. S. says, in answer to S.'s question of making sulphate of nickel: Dissolve metallic nickel in a glass flask nearly filled with a mixture of 8 parts of water and 1 part of sulphuric acid; set the flask in a sand bath apply moderate heat until a more or less dark green solution has been obtained, which, after settling and clearing, should be decanted off in a porcelain evaporating dish. Set the dish into a sand bath, apply moderate heat and evaporate slowly until a thin skin is formed on the surface of the fluid, then remove the dish from the sand-bath and let it rest undisturbed in a cool place for 24 to 48 hours, during which time crystals of sulphate of nickel will be formed on the sides and bottom of the dish; pour off the mother lye from the crystals, and put the latter in a glass or porcelain funnel provided with a paper filter through which the last portions of the mother lye may pass and the crystals dry. Preserve the crystals in a well closed glass or stone ware vessel. Sulphate of nickel by itself, without being combined with other salts, will not make a good plating solution. Another mode of preparing sulphate of nickel is by dissolving metallic nickel in diluted sulphuric acid by the action of a galvanic battery.

J. D. H. says: It seems clear to me that the answer to "J. L. B.'s" question, why a glass jar on a wet cloth may be filled with hot liquids without breaking, is simply this: The water in the cloth retards the heating of the bottom of the jar and thus obviates that sudden unequal expansion of the parts of the jar which would otherwise take place. Would not setting the jar in a vessel containing a little water answer the same purpose?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Our Present Knowledge of the Sun. By G. W. T.

On a Method of Supplying New York City with Salt Water. By J. P.

On the Transplanting of Trees. By A. K. S.

On Distinguishing Fibers in Mixed Goods. By C. S.

On the Government Works at Hell Gate. By M. G.

On the Collection and Reduction of Photographic Wastes, such as Silver and Gold. By C. L. L.

On Boiler Strains and Perpetual Motions. By J. C.

On the Laundry. By J. K. D.

On the Cause of the Gulf Stream and other Ocean Currents. By J. P. W.

On Positive and Negative Forces. By E. B.

On Phonography and Phonotypy. By E. B. S.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

February 25, 1873,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

24,199.—GAS REGULATOR.—E. H. Covel. May 14.
24,200.—HYDROCARBON APPARATUS.—E. H. Covel. May 14.
24,227.—CULTIVATOR.—R. M. Melton. May 14.
24,531.—GAS RETORT.—W. Beaument. June 11.
24,588.—HAY MAKING MACHINE.—J. C. Stoddard. June 11.
24,664.—RAILROAD FROG.—G. P. Sanborn, W. Mansfield. June 18.
25,014.—CUTTING WOODEN WARE.—G. R. Hay. July 23.
25,199.—FEEDING PAPER.—R. M. Hoe. August 6.

EXTENSIONS GRANTED.

23,060.—ELECTRO-MAGNETIC FIRE ALARM.—M. G. Farmer.
23,097.—CHAMFERING BARRELS.—H. Littlejohn.

DESIGNS PATENTED.

6,456.—OTTOMAN.—C. J. Conradt, Baltimore, Md.
6,457.—OTTOMAN.—J. D. Ladd, New York city.
6,458.—CHAIR FRAME.—E. Seymour, C. E. Shattuck, Clinton, Iowa.
6,459.—FONT.—A. E. Van Wert, Binghamton, N. Y.

TRADE MARKS REGISTERED.

1,142.—EYE SALVE.—W. T. Blow, St. Louis, Mo.
1,143.—PEARL WHEAT.—J. B. Clow, Allegheny City, Pa.
1,144.—HARNESS COMPOUND.—S. E. Cox & Co., N. Y. city.
1,145.—PICKLES AND SAUCES.—Crane & Co., N. Y. city.
1,146.—CUTLERY.—N. Joseph, San Francisco, Cal.
1,147.—SALVE.—G. Long, Keytesville, Mo.
1,148.—BAKING POWDER.—Moody Bros., Indianapolis, Ind.
1,149.—PLOWS.—E. Remington & Sons, Ilion, N. Y.
1,150.—GIN.—W. P. Sanger, New York city.
1,151.—PILE REMEDY.—M. H. Stoner, Skaneateles, N. Y.
1,152.—PRINTED PUBLICATIONS.—D. Williams, N. Y. city.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
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On an application for Design (7 years)	$15
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TWENTY-SEVENTH ANNUAL STATEMENT

OF THE

Connecticut Mutual LIFE Insurance Company,

OF HARTFORD, CONN.

NET ASSETS, January 1, 1872,		$30,745,677 24
RECEIVED IN 1872:		
For Premiums,	$7,715,067 83	
For Interest and Rents	2,039,353 16	
		$9,754,420 99
		$40,500,098 23

DISBURSED IN 1872.

TO POLICY-HOLDERS:		
For claims by death and matured endowments,	$2,211,991 56	
Surplus returned to Policy-holders,	2,906,213 09	
Lapsed and surrendered Policies,	678,809 91	
		$5,797,014 56
EXPENSES:		
Commissions to Agents,	$586,403 12	
Salaries of Officers, Clerks, and all others employed upon Salaries,	63,496 36	
Medical Examiners' fees,	15,142 09	
Printing, Stationery, Rent, Advertising, Postage, Exchange, etc.	69,226 45	
		734,268 02
TAXES, AND PROFIT AND LOSS,		289,153 96
		6,820,436 54
		$33,679,661 69

BALANCE, NET ASSETS, DECEMBER 31, 1872.

SCHEDULE OF ASSETS:	
Loans upon Real Estate, first lien, value,	$17,652,992 52
Loans upon stocks and bonds, value,	298,508 28
Premium notes on policies in force	8,800,037 92
Cost of Real Estate owned by the Company,	1,139,972 47
Cost of United States Registered Bonds,	1,680,886 80
Cost of State Bonds,	813,900 00
Cost of City Bonds,	2,136,695 00
Cost of Bank Stock,	80,205 00
Cost of Railroad Stock,	26,000 00
Cash in bank, at interest,	1,034,350 58
Cash in Company's office,	26,782 23
Balances due from agents, secured,	39,386 14
	$33,679,661 69
ADD:	
Interest accrued and due,	$975,580 29
Market value of stocks and bonds over cost,	214,457 52
Net premiums in course of collection,	38,012 71
Net deferred quarterly and semi-annual premiums,	28,428 92
	1,256,479 44
Gross assets, December 31, 1872,	$34,936,141 13
LIABILITIES:	
Amount required to reinsure all outstanding policies, net, assuming 4 per cent, interest,	$29,050,000 00
All other liabilities,	747,053 00
	$29,797,053 00
Surplus, December 31, 1872,	$5,139,088 13

Increase of assets during 1872,	$2,957,739 47
Ratio of expenses to receipts in 1872,	7.53 per cent.
" " " " 1871,	8.12 "
" " " " 1870,	8.85 "
" " " " 1869,	8.45 "
Policies in force, Dec. 31, 1872, 62,868, insuring	$181,996,167 00

JAMES GOODWIN, President.
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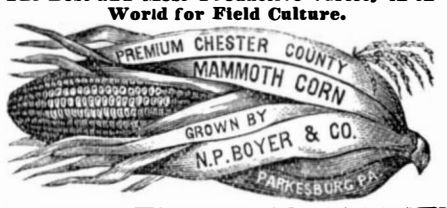

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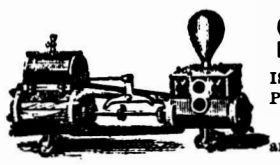

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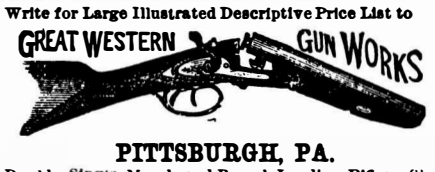

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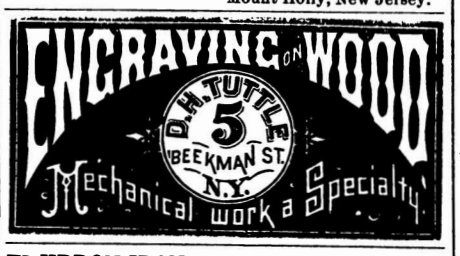

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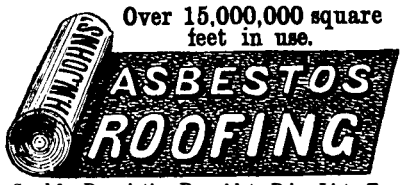

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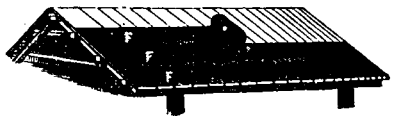

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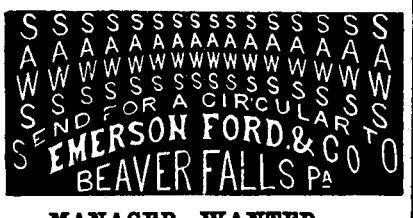

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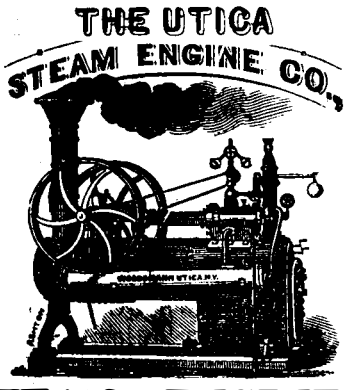

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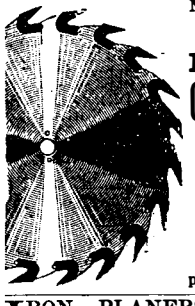

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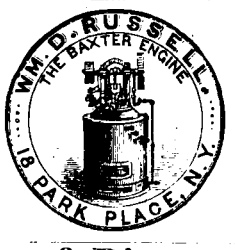

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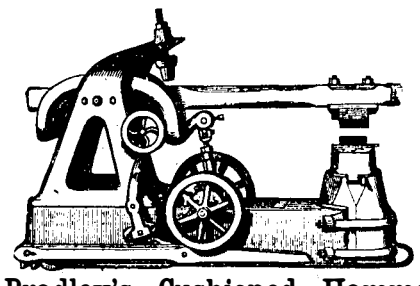

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